SCIENTIFIC AMERICAN

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AMERICAN INDUSTRIES—No. 82.

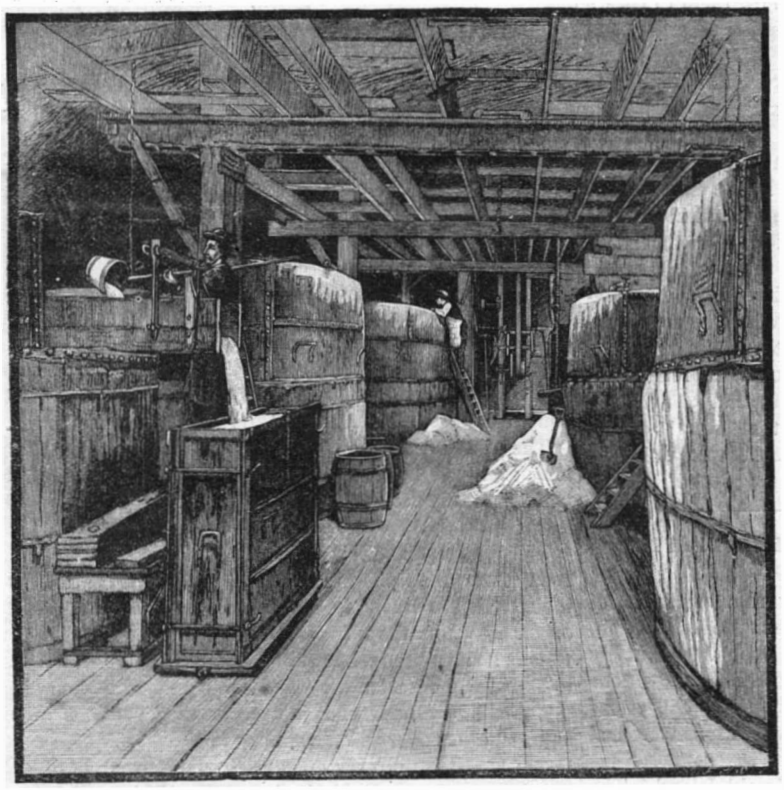
THE MANUFACTURE OF SOAP.

The old folks who were "raised" in the country will at once recognize the scene so cleverly depicted in our first illustration. It is the family soap making—something which is almost a thing of the past. Home-made soap has gone with home-made candles. The only good feature about it was that the housekeeper "knew what it was made of." It was rarely a success; it was either a soft, "putty-like," greasy mass, that had no effect, as far as cleansing goes, or else it was so strong with lye that it reddened and burned the skin in using it, and undoubtedly was as responsible for the holes in clothing as the actual wear, for the over-strong lye attacks the fiber. The modern housewife buys her soap ready-made. She generally buys a certain kind, either because it looks attractive, smells nice, or seems cheap; but, generally, because the grocer recommends it. Why he should recommend one kind more than another may be laid to the score of profit—"that which pays best, sell most of" is his motto. The reason the grocer does not recommend soap that has lasting qualities is because his customers would use less soap, so would not patronize him so often. She should use her own judgment, remembering that "the best is the cheapest;" for, next to our eating, drinking, and clothing, soap is the most important of all the thousand-and-one things that go to make up the sum of our every-day life. That the public may know something about soap-making, this article is written, in a plain, untechnical, and, it is hoped, interesting manner, aided by a series of engravings, illustrative of the process of manufacture used by the well-known firm of Procter & Gamble, Cincinnati. The earliest mention of soap—outside the Bible—is by Pliny the Elder, twenty-three years after Christ. He says that soap made of tallow and wood ashes was the invention of the Gauls. The Romans considered soap to be of Celtic invention. The inhabitants of Pompeii possessed at least one complete soap-boiling establishment, which, when brought to view after having been been buried more than 1,700 years, was found to contain soap still in a state of preservation. To the Germans must be given the credit of first manufacturing both hard and soft varieties of soap, hence the propriety of Procter & Gamble calling their famous laundry soap "Mottled German Soap," or, more properly speaking, the "Original Mottled German Soap."

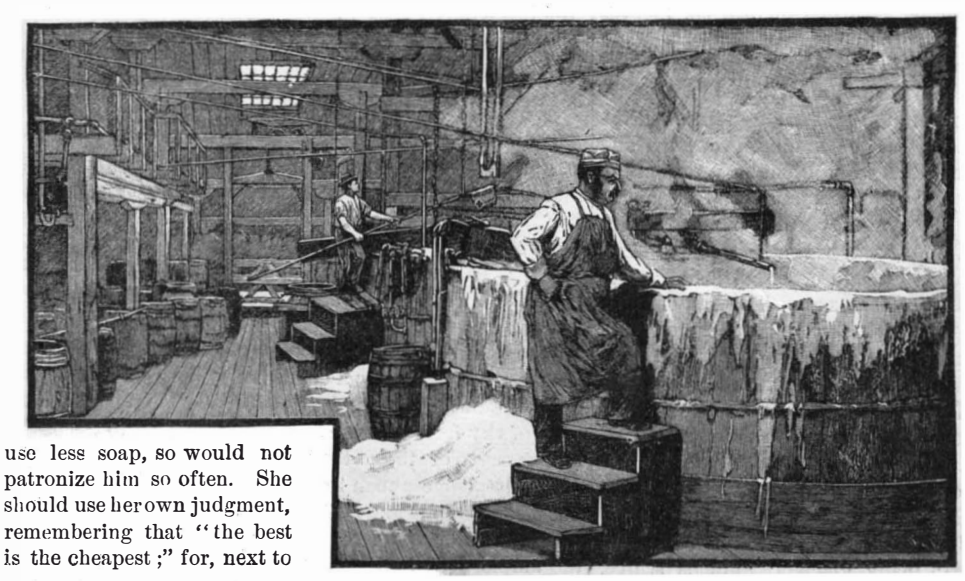
"Pure hard soap is a chemical combination of soda and fat (oil), mingled under conditions favorable to their union." That it may be understood just what constitutes "favorable conditions," and how necessary it is to have an intelligent supervision over

[*Continued on page* 99.]

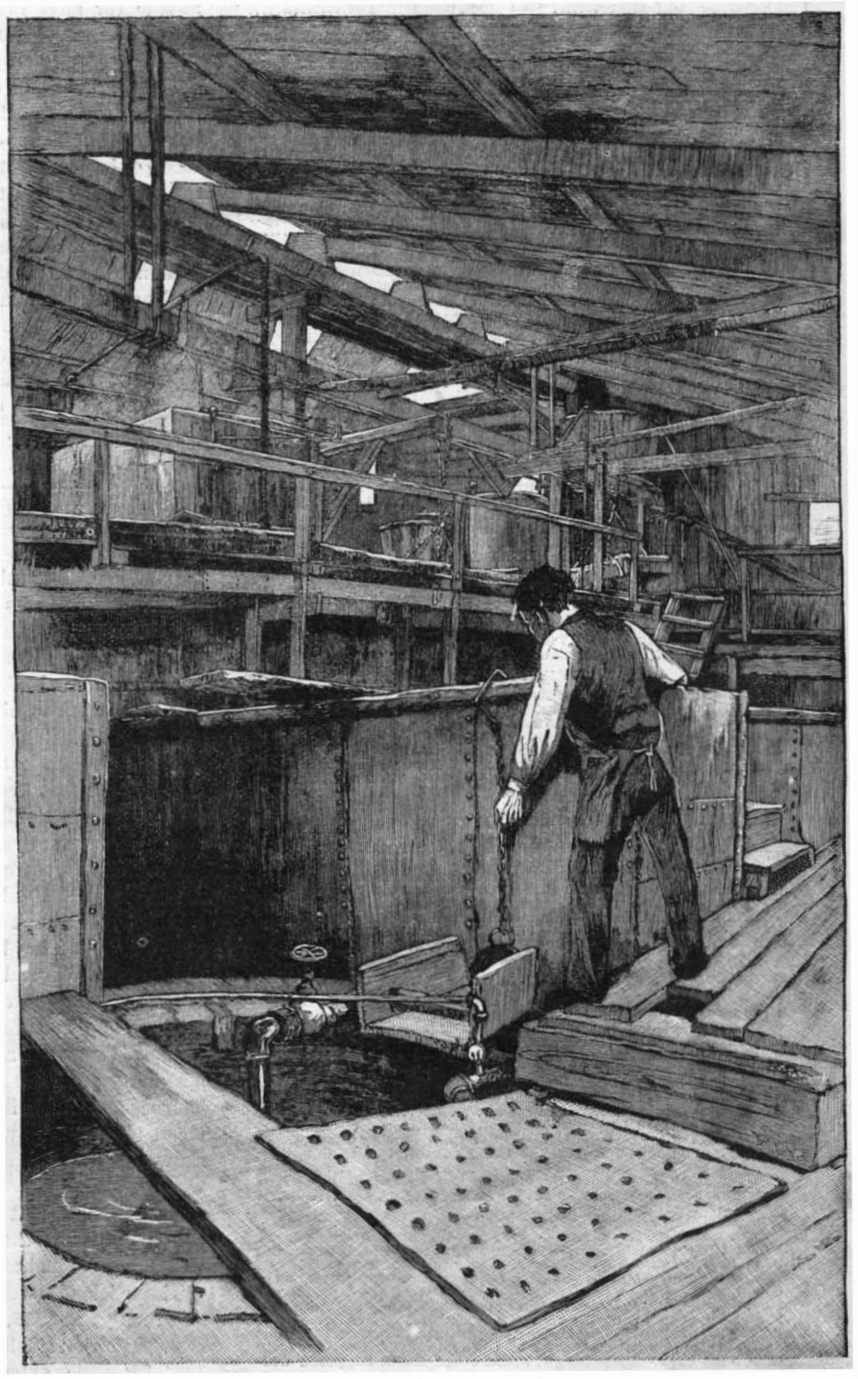
SOAP MAKING.—THE OLD METHOD.



DIPPING THE SOAP INTO FRAMES.



BOILING WITH ALKALIES.



MAKING LYE.

THE MANUFACTURE OF SOAP.—FACTORY OF PROCTER & GAMBLE, CINCINNATI OHIO.

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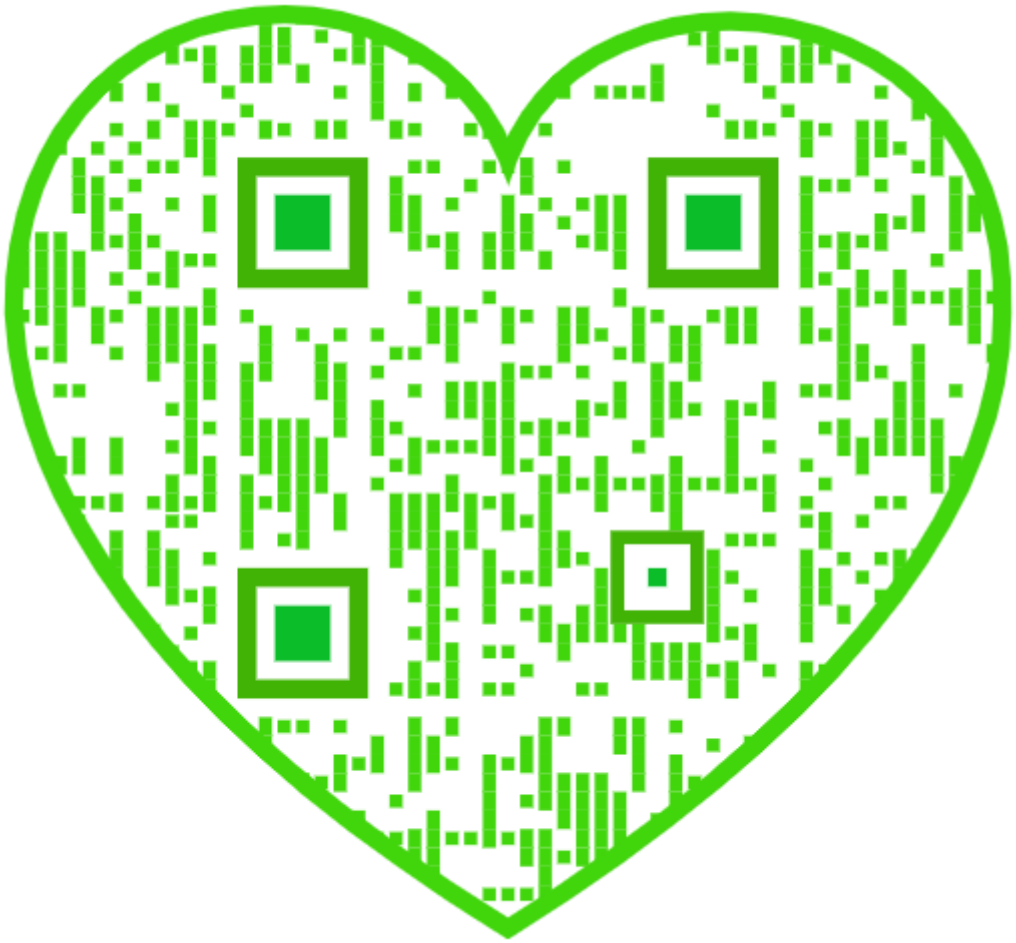

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NEW YORK, SATURDAY, FEBRUARY 18, 1882.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions..... 100
American industries*..... 95, 99
American woolen manufactures. 100
Astronomy prize, Lalande..... 97
Atlantic transit, saving time in.. 97
Awards to workmen for invent'n 100
Beets, wine from..... 97
Blood, a new constituent of the. 105
Boat, fastest, in the world..... 106
Boiler notes, steam..... 97
Boilers, steam, sup. with water*. 98
Brick walls, water-tight..... 105
Bridge, Brooklyn, cars on..... 97
Bridge, railway, highest..... 104
Car wheels, steel tire, improved. 106
Cars on Brooklyn bridge..... 97
Cars, railway, stoves & lamps in. 105
Census of the oyster industry... 97
Coffee in digestion..... 105
Coins, mutilated..... 100
Comet seeking..... 96
Copper, arsenical, purifying..... 97
Digestion, coffee and sugar in.... 105
Electric lighting by water power. 102
Engineering inventions..... 106
Engine, portable, improved*..... 102
English channel tunnel..... 102
Expanded reissue, a case of..... 96
Explorer Leichhardt's journals.. 104
Fastest boat in the world..... 106
Fire apparatus, self acting..... 104
Firearms vs. farming impits..... 98
Fires and firemen in London..... 104
Foreigners in our cities..... 97
Glycerin, detection of..... 101
Goat, angora, the..... 104
Grebes and their nests*..... 103
Hawser, twenty-one-inch, a..... 106
Herbaceous plants, hardy..... 101
Holy well, the water of a..... 100
Industries, American*..... 95, 99
Industry, oyster, census of the... 97
Inventions, agricultural..... 100
Inventions, award to workmen.. 100
Inventions, engineering..... 106
Inventions, mechanical..... 98
Inventions, miscellaneous..... 104
Inventions, new..... 103
Inventions, recent..... 102
Iron and copper, reactions for... 101
Iron and steel production..... 97
Jeannette expedition, the..... 96
Lake Michigan, a walk under.... 102
Lamps in railway cars..... 105
Leichhardt's journals..... 104
Lick observatory, the..... 101
Lighting, electric, water power.. 102
Light, oxyhydrogen, the*..... 101
Magnetism of steel..... 105
Magnifying telephone, Ader's*.. 98
Mechanical inventions..... 98
New York, rapid growth of..... 104
Notes and queries..... 107
Observatory, Lick, the..... 101
Oxyhydrogen light, the*..... 101
Oyster industry, census of the... 97
Palliser, Sir William..... 97
Patent department, new prop... 104
Patentees, relation of the gov't. 96
Patent office, work in the..... 97
Plants, the, symbolical signs of'. 103
Plants, herbaceous, hardy..... 101
Plants, ripening of certain..... 105
Portable engine, improved*..... 102
Prize, astronomy, Lalande..... 97
Reissue, expanded, a case of..... 96
Results, sci., of Jeannette exped 96
Rose tree famous, end of a..... 101
Soap, manufacture of*.....95, 99
Steam boiler notes..... 97
Steel and iron production..... 97
Steel, magnetism of..... 105
St. Lawrence tunnel, the..... 104
Stoves in railway cars..... 105
Sugar in digestion..... 105
Symbolical signs of the planets*. 103
Tan bark for exportation..... 104
Telephone, magnifying, Ader's*. 98
Teleradiophone, the..... 98
Time, saving, in Atlantic transit 97
Tree, rose, famous, end of a..... 101
Trout breeding..... 104
Tunnel, English Channel..... 102
Tunnel, St. Lawrence, the..... 96
Walk, a, under Lake Michigan.. 102
Walls, brick, water-tight..... 105
Water, hard, how to soften..... 106
Water, the, of a holy well..... 100
Well, holy, the water of a..... 100
Wine from beets..... 97
Wintergreen, essence of..... 106
Woolen manufactures, American 100

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 320,

For the Week ending February 18, 1882.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—The Trial of the Alarm..... 5096
Garrett's Submarine Torpedo Boat. 5 figures.—Garrett's torpedo boat.—Elevations.—Longitudinal section.—Sectional plan.—Cross-sections in front of boiler and through engine room..... 5096
Improved Steam Engine. 2 figures.—Pittler and Elze's steam engine..... 5098
A Smoke Consumer. 1 figure.—Gowthorpe's new smoke consumer..... 5098
Steam Hammer for Bossing Wheels. 1 figure.—Steam hammer for working upon railway wheels..... 5098
How Railway Time Tables are Arranged..... 5098
An Improved Dynamometer. 2 figures.—Tatham's improved dynamometer..... 5100

II. TECHNOLOGY AND CHEMISTRY.—Manufacture of Gun Cotton at the Stowmarket Works. 7 figures.—The general arrangement of the Stowmarket Works, with detailed description of the processes employed..... 5099
Gun Cotton, Gun Cotton Powder, and New Dynamite.—Processes of manufacture and comparative tests of quality and efficiency.... 5100
The Vapor Density of Iodine. By M. BERTHELOT..... 5103
The Purification of Gas by Ammonia. By F. D. MARSHALL..... 5103
Improved Methods in Refining Petroleum.—Report of the special committee of the New York State Board of Health..... 5103
The Present State of the Rosaniline Question. By A. ROSENSTIEHL..... 5104
Action of Ozone on Germs. By E. CHAPPUIS..... 5104
Reserve for Aniline Black. By HORACE KOECHLIN..... 5104
Gelatine.—Methods of producing and purifying commercial gelatine..... 5104
Analysis of Almeira Grape Juice. By J. CARTER BELL..... 5104
The Appert Process for Preserving Foodstuffs..... 5104
Note on the Efficiency of Centrifugal Machines for the Separation of Cream from Milk. By A. R. SMETHAM..... 5104
Action of Chloride of Lime upon Alcohols..... 5104
The Influence of Atmospheric Rarefaction on the Illuminating Power of Gas..... 5105
Phosphorescence. By J. CHAPPUIS..... 5105
Filtering Gelatine Emulsions. 1 figure..... 5107

III. AGRICULTURE, ETC.—Report on Condensed Milk. By Dr. AUG. VOELCKER..... 5105
The Nature of Swamp Muck and its Value in Agriculture. By Dr. JAMES R. NICHOLS. Muck and peat.—Origin of muck deposits.—Their age.—Differences in muck.—Muck proper.—Chemistry of muck beds.—Nitrogen in muck.—Analysis of muck.—Analysis of cow manure.—Analysis of liquid excrement.—Muck humus.—Farm trials of muck.—Views upon the value of muck.—Conclusions..... 5105
Silos and Ensilage. Practical tests and results in New England. 5107
Ensilage in Nature. The stomach of a ruminant a miniature silo. 5107
Mulching for Peach Borer..... 5107
Progress in American Silk Culture..... 5107

IV. HYGIENE AND MEDICINE.—Hints on Home Sanitation. A valuable practical paper read at the Brighton Health Congress. By H. H. COLLINS..... 5101
A Practical Method for Preventing the Spread of Infectious Diseases in Households. By Dr. MALCOLM MCLEAN..... 5102
Filaria Sanguinis Hominis..... 5103

V. ELECTRICITY, MAGNETISM, ETC.—Magnetic Disturbances, Auroras, and Earth Currents. By Prof. W. GRYLLS ADAMS. A Royal Institution lecture, describing minutely the instruments used in a magnetic observatory.—The causes and variations of magnetic earth currents.—Recent observations.—Improved methods of recording observations.—Magnetic storms.—Atmospheric electricity.—Aurora borealis.—Solar causes of magnetic storms on the earth, etc..... 5108

VI. GEOGRAPHY.—Recent Arctic Explorations. 3 figures. Portrait of Lieut. De Long, Commander of the Jeannette. The Jeannette in the Ice Pack.—Eira Harbor, Franz Josef Land, supposed winter quarters of Mr. Leigh Smith..... 5095

VII. ASTRONOMY, ETC.—The Sun's Color..... 5110
The Sky as a Cemetery..... 5110

VIII. BIOGRAPHY.—Carl Louis Schwendler, Telegraphic Engineer, Inventor, and Electrical Investigator..... 5101

ANOTHER CASE OF EXPANDED REISSUE.

Mr. Justice Bradley, of the Supreme Court of the United States, delivered, January 9, an opinion which fittingly supplements the decision of the same court in the case of Miller against the Bridgeport Brass Company, lately noticed in these columns.

In 1863 Marcus P. Norton patented an implement for stamping letters. The patent was surrendered and reissued in 1864, and again in 1869, and again in 1870.

On the basis of the last reissue suit for infringement was brought against Postmaster James, of this city, by Christopher C. Campbell, who claimed to be assignee of Norton, the patentee. Other parties claiming an interest in the patent were made parties to the suit. The Circuit Court of the United States for the Southern District of New York rendered a decree in favor of the complainant. The defendant appealed to the Supreme Court, whose decision has now reversed that of the lower court, on the ground that the reissue patent, on which suit was brought, was void for the reason that it was not for the invention specified in the original patent.

In determining the invalidity of the claims upon which the suit was brought, Mr. Justice Bradley minutely reviewed the historical and mechanical development of canceling and post-marking stamps, tracing the gradual expansion of the Norton patent in its successive reissues until it was made to cover not merely devices in common use at the date of the original patent, but also those particular devices which Norton in the original patent professed to improve upon and displace. And, still more, it was made to cover the general process of stamping letters with a post-mark and canceling stamp at the same time, a process which was not even suggested in the original patent.

"The truth is," the court remarked on summing up the evidence, which is recited at great length, "that when he [Mr. Norton] made his original application, and got his original patent, all the documents show demonstrably that he did not intend to embrace any such broad invention. That was not the invention he sought to secure. Having obtained a patent for his specific device and combination, if he wished to claim the general combination, and had not already abandoned it by taking a narrower patent, he was bound to make a new application for that purpose. Patentees avoid doing this when they can, and seek to embrace additional matter in a reissue, in order to supersede and get possession of the rights which the public by lapse of time or other cause have acquired in the meantime. It is for this very reason that the law does not allow them to take a reissue for anything but the same invention described and claimed in the original patent."

It is much to be regretted that the Patent Office (owing to deficiency of means or the inability of examiners to handle properly the increasing volume of work put upon them by our fertile inventors) has not always been able to keep reissued patents within their proper bounds. In the case in hand the broad claims of the reissued patent embraced inventions which had been patented both in England and in this country prior to the patentee's application for the original patent.

As neither of the devices used by the defendant was covered by the complainant's patent, construed as the court considered it must be to have any validity at all, the decree of the Circuit Court was reversed and the cause remanded, with directions to dismiss the bill of complaint.

The moral of this case is substantially that brought out by the case of Miller *vs.* the Bridgeport Brass Company, already referred to.

THE SCIENTIFIC RESULTS OF THE JEANNETTE EXPEDITION.

Lieutenant Danenhower has sent forward a statement of the scientific results of the ill-fated Jeannette expedition. Notwithstanding the ship was keeled over and heavily pressed by the ice most of the time, all possible observations were kept up. Unfortunately the photographic collections and Lieutenant's Chipp's 2,000 auroral observations were lost with the ship. The naturalist's notes were saved.

The Jeannette entered the ice near Herald Island. The result of the first five months' drift was forty-five miles, the ice having a cycloidal motion. During the last six months the drift was very rapid.

The soundings were pretty even. They were 18 fathoms near Wrangell Land, which was often visible 75 miles distant. The greatest depth found was 80 fathoms, and the average 35. The bottom was blue mud. Shrimps and plenty of algological specimens were brought up from the bottom. The surface water had a temperature of 20° above zero. The extremes of temperature of the air were—greatest cold, 58° below zero, and greatest heat, 44° above zero. The first winter the mean temperature was 33° below zero. The second winter it was 39° below zero. The first summer mean temperature was 40° above zero. The heaviest gale showed a velocity of about 50 miles an hour. Such gales were not frequent. Barometric and thermometric fluctuations were not great. There were disturbances of the needle coincident with the auroras. The winter's growth of ice was 8 feet. The heaviest ice seen was 23 feet.

Three islands were discovered: Jeannette Island, small and rocky; May 16, 1881; lat. 76° 47′ north, long. 158° 56′ east. Henrietta Island, May 24; lat. 77° 8′ north, long. 157° 32′ east; extensive; many glaciers; animals scarce. Bennett Island, lat. 76° 38′ north, long. 148° 20′ east. This island was large, and there were found on it many birds, old horns, driftwood, and coal, but no seal or walrus. Great tidal action was observed. The coast was bold and rocky. The cape on the south coast was named Cape Emma.

THE RELATION OF THE GOVERNMENT TO PATENTEES.

In the recent decision of the Supreme Court in the case of James *vs.* Campbell, two or three points are incidentally touched upon which very materially affect the interests of patentees in their relation to the government, especially when their inventions are such as to make them useful or necessary to the government. One is a positive ruling that the government has no right to use a patented invention without compensation to the owner of the patent; another is a query as to the propriety and probable success of a suit against the officer using the invention; and the third is a plainly expressed doubt as to whether the Court of Claims has jurisdiction when a claim is based on an unauthorized use of an invention by a government officer.

On these points the opinion of the court runs as follows: "That the government of the United States, when it grants letters patent for a new invention or discovery in the arts, confers upon the patentee an exclusive property in the patented invention, which cannot be appropriated or used by the government itself without just compensation any more than it can appropriate or use without compensation land which has been patented to a private purchaser, we have no doubt. The Constitution gives to Congress power 'to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries,' which could not be effected if the government had a reserved right to publish such writings or to use such inventions without the consent of the owner."

After mentioning certain classes of inventions useful only to the government, and the usual course of the government in dealing with their inventors, the court continues: "The United States has no such prerogative as that which is claimed by the sovereigns of England, by which it can reserve to itself, either expressly or by implication, a superior dominion and use in that which it grants by letters patent to those who entitle themselves to such grants. The government of the United States, as well as the citizen, is subject to the Constitution, and when it grants a patent the grantee is entitled to it as a matter of right, and does not receive it, as was originally supposed to be the case in England, as a matter of grace and favor."

But while the government, through its officers, has no right to use a patented invention without payment, there would appear to be no statute forbidding an infringement of an inventor's patent by an officer acting for the government, nor any statute to determine the mode by which a patentee may seek compensation for the use of his invention without his consent. The court said:

"The most proper forum for such a claim is the Court of Claims, if that court has the requisite jurisdiction. As its jurisdiction does not extend to torts, there might be some difficulty as the law now stands in prosecuting in that court a claim for the unauthorized use of a patented invention, although, where the tort is waived and the claim is placed on the footing of an implied contract, we understand that the court has in several instances entertained the jurisdiction."

The question of the jurisdiction of the Court of Claims has never been brought before the Supreme Court, and the court naturally declined to pass upon it until properly called upon.

If, however, the Court of Claims has no jurisdiction in such cases; and if, as the Supreme Court now intimates, the inventor is not likely to obtain redress by suit against the officer by whom the infringement is made (no statutory provisions having been made for such a suit), there would seem to be here an occasion for early Congressional action.

The country has need just now of inventions of use chiefly to the government, notably in the matter of coast defense; and it is not very encouraging to inventors to know that in case of an unauthorized use of their inventions by a public officer, there are no assured means whereby they can stop the wrong or secure redress.

COMET SEEKING.

The number of comet seekers is so few, compared with the amplitude of the tracts of sky to be explored nightly, that it is probable that many celestial visitors escape detection. Several observers may be simultaneously at work upon one region, while larger areas may be left entirely unexplored. To prevent such unintentional waste of time and labor the *Science Observer* suggests a mapping out of the heavens and an allotment of special tracts to particular observers, who shall agree to explore them nightly. This wise plan is accompanied by a condition which, it strikes us, is not so commendable; and that is, that each recipient of a tract of sky for comet hunting shall agree not to trespass on the preserves of the rest of the comet seekers. It is quite proper to pledge a man to work his own field thoroughly; but if he has time and inclination to do more, why shouldn't he? And what is more likely to spur on a comet seeker to the ample and thorough sweeping of his sky tract as the thought that if he misses a comet his neighbor may chance to find it, and so convict him of negligence or incapacity?

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STEAM BOILER NOTES.

On January 9 the boiler of engine 167, on the north bound Illinois Central suburban train from Hyde Park, Ill., exploded as the train was pulling into Oakland Station. The end of the engine was blown out, and a stream of glass, splinters, and broken iron was sent into the car and upon the passengers. The engineer, John Glover, the fireman, Edward Scanlon, and a boy were badly burned and cut. The boiler was carried several hundred feet through the air, and came down through the roof of a workshop. It is a miracle that nobody was killed. The boiler was defective.

A boiler in Shaw Brothers' Tannery, at Jackson Brook, Me., exploded early Saturday morning, January 21, killing Thomas Lacy, the engineer. The exploded boiler was thrown fifty feet. Two other boilers were lifted from their bed. Two smokestacks were thrown down. The boiler house and furnace were wrecked.

The tug H. P. Farrington, the property of Cornell's Tow Line, was blown up at 7 o'clock P.M., January 23, while lying at Peck's Dock, Haverstraw, N. Y., and totally destroyed. The crew consisted of seven men, all of whom were on board at the time. Pieces of timber were scattered over the neighboring brickyards, and a coal-bunker deck ring was blown a distance of 300 feet or more. A dozen or so of the boiler tubes, which were 4 inches diameter and 9 feet long, were the only parts of the boiler that could be found in the vicinity, all else, with the boat itself, sank in the river and were soon covered with ice. The shock from the explosion was felt in many of the houses in the village, which is about one-quarter of a mile from Peck's Dock. The following persons were killed: Albert Hennion, second engineer, David Colton, fireman, and Lawrence Connelly, cook.

A boiler exploded in Cañon City, Cal., on Wednesday, January 25, resulting in the death of two men. The boiler was located at a shaft of the Cañon City Coal Company. The result of the explosion was the killing of a fireman outright and injuring a blacksmith so badly that he has since died. The engineer had a leg broken, and was badly scalded. The boiler was thrown a distance of 300 yards.

One of the boilers in the shade cloth factory owned by Irwin & Sloan and others, exploded December 27, before daylight in the morning. The middle of the building was demolished. Captain William Doran, night watchman, was instantly killed. He was the only person in the works at the time. The boiler had been shut off for cleaning on Christmas Day, and the steam stop valve had not been opened when the explosion occurred. The shock was terrific, and parts of the boiler were scattered over a large area. The boiler was under the inspection of an insurance company that had some $6,500 at risk. The loss on the building and machinery is about $15,000.

The boiler in the steam mill of the Kennebec Framing Company, at Fairfield, exploded, Jan. 28, with terrific force. A son of ex-warden Rice was killed, and John Avery, the foreman, Lemar, the fireman, and Isaac Farley, the engineer, were buried in the ruins. George McKeown and John Smith, a foreman, were wounded, and several others slightly injured. The underwork of the mill took fire. The accident is supposed to have been caused by a lack of water in the boiler. The explosion was accompanied by a deafening report, which jarred the houses all over the village and caused many to think an earthquake was taking place. The boiler, an old steamboat boiler, had been patched a number of times, and had been considered, it is said, very dangerous for months. The company was intending to put in a new one in the spring. The engineer says he had repeatedly told the manager of the great danger of an explosion. The management is greatly blamed by the citizens.

The boiler in the Belleville (Ill.) Nail Mill exploded, January 30, and almost totally destroyed the building. Several persons were seriously injured, William Davis probably fatally. Damage, $20,000; insured. Two hundred men and boys were thrown out of employment.

The Lalande Astronomy Prize.

At the annual meeting of the French Academy of Sciences February 6, the Lalande Astronomy Prize was awarded to Dr. Lewis Swift, of Rochester, N. Y.

The record of Dr. Swift as a scientific observer adds a new illustration to the truth, which students should never forget, that earnest and persevering efforts count for more than money and opportunity as elements of success. Most of Dr. Swift's work was done with the rudest appliances of his own making, used under anything but favorable conditions.

Movement of Cars on Brooklyn Bridge.

The report of the Bridge Committee on Transit recommends the circulating railway system for the Brooklyn Bridge. This system is operated by an endless wire rope, terminating in an elevated platform at the height of the elevated railroads in this city, and extending 600 feet from the terminus of the bridge. By this system the cars would be passed in one direction on one track and in the opposite direction on another track. The report of the committee concluded with a favorable opinion of the system by Engineer Roebling. The platforms, etc., would cost, according to the engineer's estimate, $268,980; engines, boilers, foundation for machinery, sheaves, ropes, $73,439; boiler house and machine shop, $12,000; rolling stock, comprising thirty-four cars, having side doors, $4,125 each, making $99,000. The total cost of the circulating system would be about $500,000, including an estimate for contingencies

TEN YEARS' PROGRESS IN IRON AND STEEL PRODUCTION.

The advance sheets of the census report on the production of iron and steel, prepared by special agent James M. Swank, show an encouraging progress during the decade since the preceding census, both in the quantity of the product and in the efficiency and economy of the processes employed.

The report covers only productive establishments, such as turn out pig iron, rolled iron, steel in crude state, blooms, and bar iron. A comparison of the main items for the last two census years shows as follows:

	1880.	1870.	Incr. p. ct.
Establishments	1,005	808	24·38
Hands employed	140,978	77,555	81·78
Wages paid	$55,476,785	$40,514 981	36·93
Capital invested	230,971,884	121,772,074	89 68
Value of materials	191,271,150	135,526,132	41·13
Value of products	296,557,685	207,208,696	43·12
Tons produced	7,265,140	3,655,215	98·76

It will be noticed that the increase in quantity is much greater than the increase in cost, indicating greater economy in the methods employed. When the values have been reduced to a gold basis (the gold dollar of 1880 being worth nearly one-fourth more than the current dollar of 1870), it is found that the actual increase in wages was 68·8 per cent., while the gold value of the products was larger in 1880 by 76.4 per cent. The largest increase in quantity was in the various grades of steel, as will be seen from the following analysis of the products, the quantities being tons of 2,000 pounds:

	1880.	1870.	Incr., p. ct.
Pig iron and castings	3,781,021	2,052,821	84
Rolled iron	2,353,243	1,441,829	63
Bessemer steel	889.896	19.403	4,486
Open hearth steel	93.143	—	—
Crucible steel	70,310	28,069	151
Blister and other steel	4,956	2,285	117

The substitution of steel for iron in rails and other products caused a decline of 35 per cent. in the output of forges and bloomeries.

The great bulk of the product of iron and steel (nearly eight-tenths) is credited to Pennsylvania, Ohio, New York, Illinois, and New Jersey; and more than half of all was produced in fourteen counties, as follows:

Counties.	Tons.	Counties.	Tons.
Allegheny, Pa.	848,146	Mercer, Pa.	182,881
Lehigh, Pa.	324,875	Rensselaer, N. Y.	177,967
Northampton, Pa.	322.882	Montgomery, Pa.	168,628
Cambria, Pa.	260,140	Lackawanna, Pa.	151,273
Cook, Ill.	248,479	Milwaukee, Wis.	128,191
Dauphin, Pa.	223,676	St. Louis, Mo.	102,644
Mahoning, Ohio.	219,957		
Berks Pa.	213,580	Total (fifteen) counties	3,783,673
Cuyahoga, Ohio.	210,354		

The greatest advance during the decade was made in Cook County, Ill., which in 1870 produced only 25,000 tons of rolled iron.

In the five States named, where most of the iron workers are employed, the wages of skilled and unskilled labor in the various branches were:

	Pa.	Ohio.	N. Y.	Ill.	N. J.
Blast furnaces, S.	$1 64	$1 84	$1 77	$2 17	$1 75
Blast furnaces, U.	1 09	1 25	1 14	1 3	1 20
Rolling mills, S.	3 03	3 87	2 93	3 67	2 78
Rolling mills, U	1 17	1 32	1 22	1 25	1 22
Bessemer works, S	2 46	3 96	2 18	5 00	—
Bessemer works, U.	1 17	1 34	1 07	1 15	—
Forges and blooms, S	2 43	—	2 48	—	2 24
Forges and blooms, U.	1 11	—	1 14	—	1 19
All works, S.	$2 32	$2 89	$2 43	$3 43	$2 32
All works, U.	1 13	1 30	1 18	1 27	1 21

The average wages of skilled labor throughout the country was $2.59, and of unskilled labor, $1.24.

Foreigners in our Cities.

The numbers, nationalities, and increase of the population of our principal cities are discussed in a recent census bulletin.

The first five in order of population are New York, with a population of 1,206,299; Philadelphia, 847,170; Brooklyn, 566,663; Chicago, 503,185; and Boston, 362,839.

In 1870, New York had a population of 942,292; Philadelphia, 674,022; Brooklyn, 396,099; Chicago, 298,977; and Boston, 250,526. During the past decade New York has added to its population more people than now reside in Cincinnati, and more than Boston had ten years ago. There are somewhat over 21,000 more women than men in the city, and 249,000 more natives than foreigners. The proportion of natives to foreigners in Philadelphia is much greater than in New York, or roughly three to one against three to two in New York. In Brooklyn the native proportion is somewhat more than double the foreign.

The second group of cities comprises St. Louis, 350,518; Baltimore, 332,313; Cincinnati, 255,139; San Francisco, 233,959; and New Orleans, 216,090.

In proportion of foreign population San Francisco ranks with Brooklyn; St. Louis and Cincinnati about with Philadelphia. In Baltimore the natives are nearly six times as numerous as those of foreign birth. Further south the native born overwhelmingly predominate.

Method of Purifying Arsenical Copper.

The author operates on a basic hearth of lime and tar, according to the process of Riley and Gilchrist, and at each operation he uses a false hearth of limestone mixed with peroxide of manganese. During the fusion of the ingots this false hearth is heated and gives off carbonic acid and a part of its oxygen. These gases traverse the mass of half melted copper. When the bath is sufficiently liquid the lime and the manganese oxide thus formed rise through the copper and dissolve the arsenic acid, which passes into the slag. To expel the last traces the copper is allowed to become pasty in a current of air, and is then remelted with the addition of basic fluxes till entirely purified.—*J. Garnier.*

Proposed Saving of Time in Atlantic Transit.

The time required for the conveyance of mails from New York to London is given as follows: New York Post Office to Sandy Hook light, 3h. 30m.; Sandy Hook to Queenstown (best average time 1881), 8d. 13h. 45m.; delay of mails at Queenstown, 1881, 3h. 30m.; Queenstown to London, 22h.; total, 9d. 20h. 45m.

It is proposed to better this time by means of swift steamers plying between the eastern extremity of Long Island and the new port of Milford Haven, in Wales. The time by the new route is estimated as follows: New York to Fort Pond Bay, via Long Island Railroad (110 miles), 2h. 30m.; transfer at Fort Pond Bay, 1h. 30m.; Fort Pond Bay to Milford Haven (southerly and lowest route 2,880 miles, at 18 miles an hour), 6d. 16h.; transfer at Milford Haven, 1h. 30m.; Milford Haven to London (322 miles), 8h.; total 7d. 5h. 30m. A speed of 20 miles an hour on the ocean, which Mr. Pearce, the English shipbuilder, offers to guarantee to vessels of his construction, would reduce the time to 6d. 13h. 30m. For seven years the construction of docks at Milford Haven has been going on, and they are now nearly ready to receive the largest steamships. They were designed by Sir E. J. Reed, late Chief Constructor of the British Navy. The dimensions of the docks are as follows: Total available dock area, 60 acres; lock 500 feet long by 70 feet wide; graving dock, 710 feet long, 96 feet wide; small graving dock, 270 feet long, 46 feet wide; depth over sills, high water spring tides, 36 feet, and at high water heaps, 27 feet; depth of water in docks, 28 feet. The cost of the docks has been about $2,650,000.

The Past Year's Work in the Patent Office.

The report of the Commissioner of Patents for the year ending Dec. 31, 1881, bears abundant evidence that there is no falling off in the activity of our inventors. The number of patents issued was 17,620, against 16,584 for the preceding year. The total number of applications requiring investigation and action was 30,242. Of these 26,059 were for patents for inventions, designs, and reissues, and 4,183 were caveats filed, applications for registration of trade marks, labels, etc. The total receipts of the office during the year from all sources were $853,665 89, and the expenditure $605,173 28. The total balance in the Treasury of the United States on account of the patent fund on January 1, 1882, amounted to $1,880,119 32.

The Commissioner urges upon Congress the pressing necessity of increasing the examining force of the office, and providing more room for the use of the office.

Census of the Oyster Industry.

For the first time the oyster trade has received appreciative treatment by a census bureau. The investigation of the industry was committed to Mr. Ernest Ingersoll, whose report has just been published, covering the history and present condition of all the oyster grounds from Canada to the Gulf of Mexico, besides those on the Pacific coast. In the census year of 1880 the capital invested in the oyster industry was $10,583,295. The number of bushels of oysters produced was 22,195,375. Their value to the producers was $9,034,861, and their value as sold was $13,438,852. The number of persons employed was 52,805, and there were used in the work 4,155 vessels and 11,930 boats, valued at nearly $4,250,000.

The total wholesale value of the oysters annually sold in Boston is $705,000; the value of the oysters produced in Narragansett Bay is $680,000; the value of those sold in New Haven Harbor is $480,000; in the East River and Peconic Bay, 708,000; on the south shore of Long Island, $400,000; in New York Bay, excluding New York city, $375,000; in New York city, $2,758,000; on the ocean shore of New Jersey, $310,000; in Delaware Bay, $2,425,000; in Philadelphia, $2,750,000; and in Virginia nearly $2,000,000, and about $125,000 will cover the value for the remainder of the Southern coast line, not including the Gulf line, where the value slightly exceeds $300,000.

Wine from Beets.

The loss of vines through the ravages of the phylloxera is forcing the wine makers of France to strenuous efforts to find a substitute. M. A. Deleuil, a member of the Agricultural Society of France, insists that an acceptable substitute has been found in a variety of red beet root, which he describes as "unrivaled in the whole world for its incomparable qualities, which will in time replace all that we have lost in the vine. Beet root produces alcohol of superior quality; why, then, should not its pulp, treated like the must of the grape, produce an equally luscious beverage? In fact, this has been done; the very sweet red beet root produces by fermentation a wine quite as good as many of the *soi-disant* wines of our southern vineyards. It possesses the additional advantage of accommodating itself to all soils, and flourishes in most climates." All this may be true; yet we fancy that American wine users at least will prefer the juice of their own grapes.

Sir William Palliser.

Major Sir William Palliser, widely known for his inventions in ordnance and armor, is dead. Among his inventions are the projectiles which bear his name; the system of converting smooth bore cast iron guns into rifled compound guns; the screw bolts used in attaching armor to forts and iron clad vessels; and many improvements in the construction of heavy wrought iron rifled cannon. He was born in Dublin, in June, 1833.

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The Teleradiophone.

M. Mercadier, the eminent French electrician, has ingeniously adapted the photophone of Professor Bell to telegraphy. In the photophone a ray of light is reflected by a mirror, so as to fall upon the sensitive surface of a "selenium cell" joined up in the circuit of a voltaic battery and a speaking telephone. When the light strikes the cell its electric resistance is diminished, and a wave or pulse of current flows through the telephone, causing it to sound. By eclipsing the ray of light a great many times per second, this sound can be exalted into a continuous hum, like that of a tuning fork, and by again occulting the intermittent ray for long and short intervals corresponding to the flashes of a signaling lantern, this hum or drone can be broken up into audible signals. Thus, if the Morse telegraphic code is used, a short occultation, producing a short pause in the note of the telephone, will stand for a "dot," and a long occultation, producing a long pause, will stand for a "dash."

This photo-electric telegraph is realized by M. Mercadier with the help of a gas flame forming the source of light, a mirror, and lenses to direct its rays upon the selenium cell in circuit with a battery and the line wire. The beam is regularly eclipsed by means of a rapidly rotating disk, perforated with a circle of holes, and the telegraphic occultations of the intermittent beam are effected by means of a signaling key, which interposes a dead screen in the track of the light whenever the key is pressed. These apparatus form the transmitter; and the receiver at the other end of the line is, of course, the telephone, which is fitted with a resonator to re-enforce the sound. There is no gain in such an arrangement over the ordinary telegraph now in use; but it has the merit of lending itself to multiple telegraphy. Thus by multiplying the number of transmitters at one end of the line and the number of telephones at the other, several different messages can be sent along the same wire at once. In order to do this it is only necessary to rotate the eclipsing wheels at different speeds, so as to produce notes of different pitch in the receiving telephones, and to fit each resonator so as to enhance a particular note. Then, although the complex current flows through all the telephones in turn, each telephone will only render to the ear of the clerk the particular note for which he listens, and the makes and breaks of that note will be interpreted as the message. Not only can several messages be sent in one direction along the same wire together, but from opposite ends simultaneously without confusion, and M. Mercadier reckons that with 10 transmitters and 10 receivers at each end of a line he can send 200 dispatches of 30 words each per hour, or 100 words per minute, in either direction. The effects of induction, so troublesome in speaking by telephone, are not experienced in this process, owing to the employment of musical notes and resonators.

ADER'S MAGNIFYING TELEPHONE.

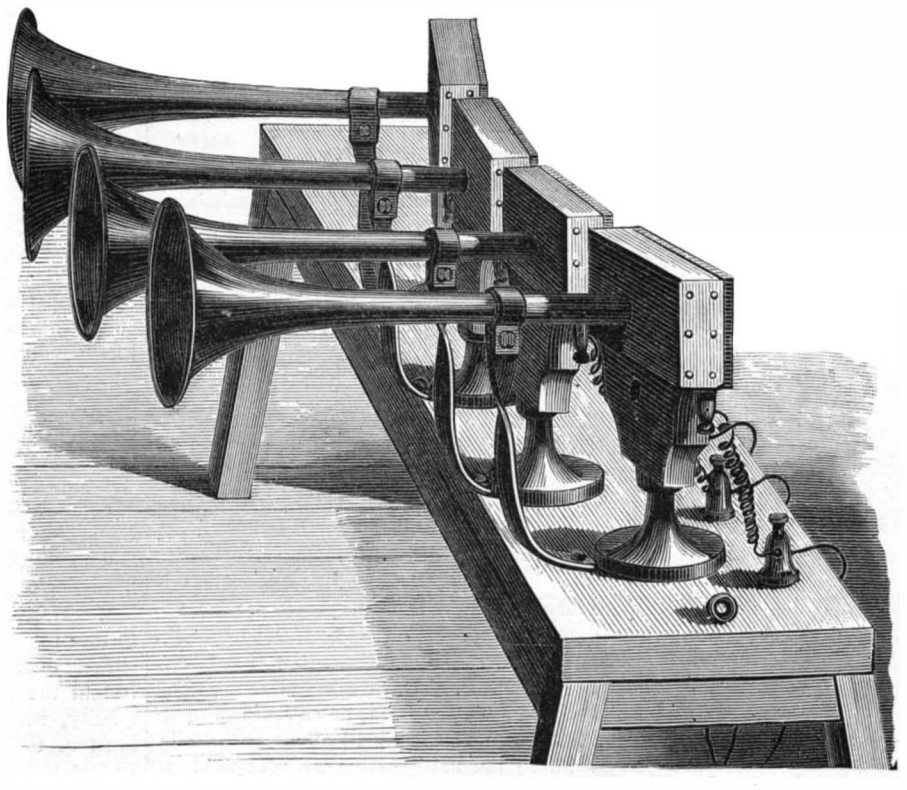
M. Ader showed, at the Electrical Exhibition in Paris, an instrument that possesses the power to magnify transmitted sounds. If a song is hummed in front of the microphones attached to the instrument, the song will be reproduced as a full quartet.

This instrument is formed of four trumpets whose mouthpieces are attached to a vibratory diaphragm (see illustration), but its interior arrangement has been kept secret by the inventor, as it is the only known instrument that is able to increase sounds transmitted through the air.

It is rightly named a microphone, as it does for the ear what the microscope does for the eye.

At present it is only able to reproduce musical sounds, but M. Ader hopes soon to magnify and reproduce articulate speech of the human voice, so that a person whose hearing is defective can hear without placing the instrument to his ear. He may possibly do this, for all telephones commenced by transmitting musical sounds only.

If M. Ader succeeds, instead of the present style of telephone, there may be telephonic offices and rooms where one can sit and talk comfortably to any distance without moving from his chair.—*La Lumière Electrique.*



ADER'S MAGNIFYING TELEPHONE.

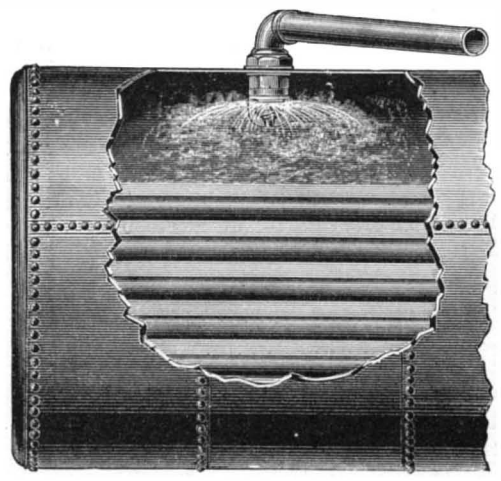
More Money in Firearms and Dirks than in Farming Implements.

The Montgomery *Advertiser* publishes a partial list of subjects of taxation in Alabama, and makes, in the main, a fine showing; but three items in the schedule strike us as being at least queer. These items are: 1st, mechanical tools, $228,509; 2d, farming implements, $77,100, making a total value of farming implements and mechanical tools of $305,600; 3d, guns, pistols, and dirks, $354,250! Or about $49,000 more invested in guns, pistols, and dirks than in farming implements and mechanical tools combined. No county in the State reports less than $1,000 worth of guns, pistols, and dirks, and the average of all the counties is over $5,000, while some of the counties have only $20 worth of mechanical tools, and only twenty-nine counties return over $1,000 worth of farming implements, and fourteen counties less than $100 worth, and some of them as little as $25. The only fair explanation of these figures must be the fact that only a very small fraction of the mechanical tools and farming implements are listed by the receivers of tax returns, for there is no year when the people of Alabama do not buy five times the amount named of farming implements.

Guns and pistols being surplus assets, they are more fully returned. We all know they are infinitely less used.—*Columbus (Ga.) Times.*

SUPPLYING STEAM BOILERS WITH WATER.

It has long been the common practice of steam engineers to supply boilers with water below the "water line," it being the general impression that to obtain the best result, the temperature of the water should be gradually raised to the boiling point. As a consequence, it is found that most



HALL & SONS' SPRAY FEED-WATER HEATER.

boilers receive the feed water at the coolest part, generally near, if not quite, at the bottom of them. As an economy so far as relates to non-condensing engines, it is usual to heat the feed water by exhaust steam to probably 180° Fah. before it enters the boiler, whenever practicable.

If all water was free from impurities, either in solution or suspension, as lime, sulphur, acids, mud, and other matter, and a uniform temperature always maintained, it would probably be a satisfactory method in most instances, but such existing examples are rare exceptions. Almost all waters throughout our land contain impurities, which are separated during the process of boiling, but as the water is admitted in volume, the temperature is raised so slowly the particles of matter unite and adhere to the exposed surfaces, forming a coating called scale. When this coating is formed, on account of its non-conducting nature, which compared with iron is as 1 to 37·5, it involves a loss of fuel in direct ratio with its thickness. When it is considered that scale one-eighth inch thick requires 28 per cent more fuel to produce the same effective heat than when the boiler would be a clean one, it of course becomes a subject for consideration and of interest to every steam user, though it must be confessed that many manufacturers do not give their boilers the attention required for economy and safety.

It is not our purpose to enumerate the attempts that have been made to effectually overcome the scourge called scale, as there have been so many inventions, mechanical cleaners, lime catchers, etc., not to mention compounds, oils, and chemical preparation, which, in most instances, fail to be of any benefit, it merely showing the urgent need of some system which will effectually meet the requirement in all cases.

Within the last few years, however, there has been some progress made in feeding steam boilers, in quite an opposite manner from the old custom, and the result seems to be satisfactory and combining several advantages. Instead of feeding in the coolest part of the boiler in volume, it is the later practice to feed in the steam space above the "water line" in the form of spray or in a finely divided state, and by contact of the water in this form with the high heat caused by the steam pressure, the water is heated (as it descends through the steam towards the water line) fully to the boiling point, thus practically distilling it and separating the impurities contained in the water, which assume a finely granulated form usually, and which, settling, can be readily disposed of at the mud valve.

Owing to the fact that in the use of the best devices for this purpose no water comes in contact with the shell or tubes of a boiler, until it is heated as hot as that at the water line, it follows there is less unequal expansion, the danger from cold currents is overcome, and "shell cracks" are avoided, thereby effecting a saving in boiler repairs, and increasing the factor of safety. This system has been adopted in many sections where almost every other means failed to be of benefit.

At Syracuse, N. Y., it has been used successfully upon the hardest lime water which heretofore baffled every means employed. Upon the muddy waters of our Western rivers it has been well tested and has given entire satisfaction, as also on mineral and mine waters of almost every known variety it has proven superior to the old way in all cases, effectually preventing scale formation and reducing boiler repairs and fuel expenses to a minimum. Supplying water to boilers in the steam space cannot be considered a late idea, but the early efforts in this direction were crude, the devices used were imperfect and could not be depended upon, being designed generally by parties that had not given the subject the study it deserved. It is unnecessary for us to recall the numerous failures, but each was a step forward and in the right direction, until now the system has been perfected, and from its adoption has received due appreciation from thoughtful, practical steam users. Among the devices which are rapidly growing in favor and receiving general approval is the patent "spray" feed-water purifiers, shown in the engraving, and manufactured solely by Hall & Sons, Buffalo, N. Y., who may be addressed for further information.

MECHANICAL INVENTIONS.

An improved regulator for spinning-mules has been patented by Mr. Lazarus B. Sanford, of Greenville, S. C. This invention has reference more particularly to improvements in mechanism for regulating the rising movement of the quadrant-nut, the object being to provide improved means for automatically regulating the tension of the yarn while the cop is being wound.

An improved device for tightening belts, especially elevator bucket belts, and giving them the required tension, has been patented by Mr. John F. Wilson, of Camden, N. Y. The invention consists of two frames, which have screws mounted in their ends for drawing these frames together or separating them, on which frames serrated or ribbed segmental interchangeable belt clamping blocks, with handles for operating them, are pivoted, which pivots can be withdrawn to remove the clamping blocks from the frame.

Mr. Albert D. Canfield, of Arlington, Vt., has patented an improvement in that class of car wheels which have steel treads with a filling of less expensive material. The invention consists in the arrangement of the segmental sections and the wedge-shaped sections, and of the manner of securing them to each other and to the hub.

An improvement in tricycles has been patented by Mr. Samuel N. Silver, of Auburn, Me. The object of this invention is to provide a new and improved tricycle, or self-propelling vehicle, which is so constructed that it can be propelled, steered, and controlled very easily by the occupant. The tricycle is provided with two pivoted foot levers connected with arms loosely mounted on the axle, and provided at the outer ends with pivoted pawls engaging in notches in disks loosely mounted on the axle, and provided with friction clutch-dogs catching on the inner surface of the circumferential flange of a disk rigidly mounted on the axle, so that when the foot levers are depressed springs on the axle connected with the loose disks, and other springs also connected with these disks, will be brought in tension, and when the pawls are released from the disks the springs revolve the loose disks which catch on the rigid disk, thereby rotating the axle and propelling the vehicle forward.

A combined tablet and easel has been patented by Messrs. Andrew B. Banghart and Charles H. Treat, of Frankford, Del. The object of this invention is to produce tablets to be painted or ornamented, and to combine therewith easels for supporting the tablets in such a manner that they can be readily taken apart and packed in small space for storage and transportation.

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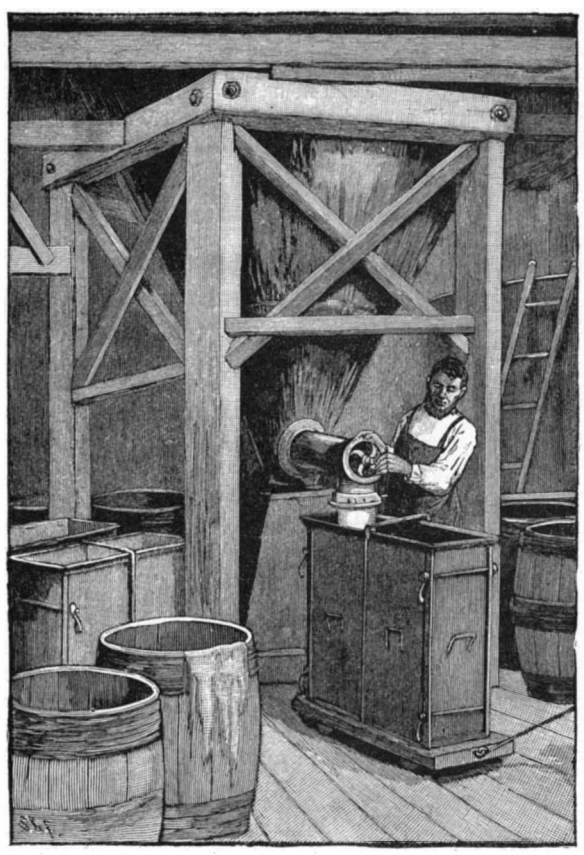
THE MANUFACTURE OF SOAP.

[*Continued from first page.*]

every detail of the process, we shall further along describe the methods pursued in making the best known hard soap.

In soap making, as in everything else, the best results are obtained only by the use of the best materials and most approved methods, combined with long and intelligent experience. Now for the materials. The basis for all soaps is either grease, tallow, or oil—grease being the least desirable, as it does not yield as good soap as tallow or oil. The latter is far superior to either of the other two. Grease is made from the fat of animals that have died, the refuse of kitchens, and other offal. Tallow is made from the fresh fat of sheep and cattle, so is not so objectionable or dangerous as grease. Oils suitable for soap are palm, cocoa nut, cotton seed, olive, and saponified red oil, the latter being especially desirable for laundry soap, as strength and durability are required. Genuine mottled German soap is made of saponified red oil only, which is superior to other "soapers'" oils, inasmuch as it is what is known as a chemically "free" oil; it readily takes hold of the alkali, and the result is a complete saponification, so a complete soap. It is hard even when fresh; there is little or no loss in weight by shrinkage, so the purchaser receives the full amount of soap for his money; that is, he does not pay for water at the price of soap. To the vast manufactory of Procter & Gamble, in Cincinnati, we go for our illustrations and our description of their process, for there the most recent and most perfect of scientific and mechanical appliances are kept at work, and the latest of scientific research is constantly utilized. Every step of the process, from the time the tallow from which the red oil is made is deposited in the emptying room until the soap is packed in boxes and sent to all parts of the country, is full either of interest to the student or entertainment to the simply curious.

As before mentioned, this firm make their mottled German soap of saponified red oil. That the reader may know what this oil is, we must first repeat the statement made in a former article, that Procter & Gamble are the largest manufacturers of candles in the country, and they obtain their materials for making candles from their process of making the oil for their soap. The combination of the two industries is essential to the successful and economical production of both. The first step is the saponifying of the tallow; it is accomplished in an apparatus called, in chandlers' parlance, the "digester," of which there are three in operation. (See illustration, p. 383, vol. xlv., SCIENTIFIC AMERICAN.) It consists of a copper cylinder, inclosed within an iron one, and a pump arranged to raise the contents of the inner cylinder from the bottom to the top. Into this the tallow, which has been melted out of the barrels by steam, is run, and is mixed with lime and water. This mixture is kept up to the intense heat of 600° Fah. by steam, which is let into the outer cylinder at a pressure of 250 pounds to the square inch. The water, being the heavier, sinks to the bottom of the copper cylinder, whence it is pumped and thrown on a perforated plate above the tallow, that it may fall through it in many little streams. This agitation is kept up for eight or nine hours, after which it is found that the lime has united with the tallow and formed a lime soap, while the water has consorted with the impurities, etc. The intense heat to which the tallow is subjected, and the continuous washing it undergoes, destroy and remove any impurities liable to produce disease there may be in the tallow, which of itself gives the Procter & Gamble soap an immense advantage over all others, for it insures to the consumer a soap absolutely pure. No other firm exercises the same amount of care in preparing the "stock" for the boiling kettles, for the ordinary method is to empty the tallow or grease, from which none of the impurities has been removed, direct into the boiling kettles, and the process of manufacture usually pursued is such as to simply warm into life any germs of disease there may be in the grease or tallow. The contents of the cylinder, after being allowed to remain at rest for a time, separate into two strata, the lime soap on top, the impurities and water below. These are blown off into separate vats by the power of steam. The cooling of the lime soap is a slow process. It is run into shallow pans, lined with enamel, and permitted to remain in a warm room two or three days. When it becomes hard, the cakes are emptied from the pans, and wrapped in heavy woolen cloths, and piled into hydraulic presses between iron plates, and the pressure applied. A dark oil gushes from the woolen, pours over the edges of the plates, and is caught by troughs conveniently arranged, from which it is conducted by iron pipes to the soap kettles. This oil is known in commerce as saponified red oil. The preparation and purifying of the lye by this firm are the most thorough known, and insuring the removal of all foreign deleterious matter. The highest grade of carbonate of soda is imported by them direct from England, from which they completely remove the carbonic acid by placing a large quantity in an immense iron tank filled with boiling water, and the entire mass kept hot and agitated by jets of steam. When the solution is complete, the hot liquor is drawn out upon a shallow iron tray having a perforated bottom. This tray contains a certain quantity of lime, and is suspended within and near the top of an iron tank, placed on a lower level than the first tank. The hot soda solution falls through the tray into the lower tank, carrying the lime with it. After being agitated, the lime settles to the bottom, carrying with it the carbonic acid and all impurities. After being allowed to settle sufficiently, the clear liquor, which is lye in its purest form, is drawn off into the soap kettles, leaving the lime, etc., in the tank. It will be seen that everything that has thus far gone into the soap kettle has been thoroughly purified and cleansed, all of which Procter & Gamble have found necessary to have done under their own supervision to insure having it honestly performed, on the principle, "If you want anything well done you must do it yourself."



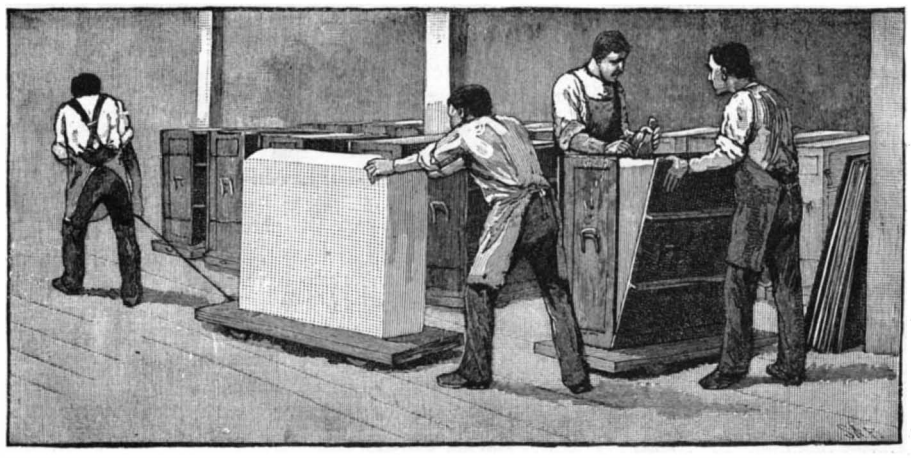
FILLING THE COOLING FRAMES.

The soap kettles are large cylindrical vessels made of boiler iron, open at the top and having a conical bottom. They are heated by means of iron steam pipes coiled into an inverted cone to correspond with the shape of the bottom. Another coil or single ring of steam pipes is placed near the bottom and perforated with numerous holes; this latter is termed the "open steam" or "blow" pipe, and the former the "close steam pipe." They are used at different stages of the boiling, to effect a thorough mingling and heating of the materials. There are pipes leading from the bottom of the kettle for the discharge of the "spent lye," and a large pipe near the bottom, through which the finished soap is drawn directly into the cooling frames, as shown in the illustration. A part of the side of the kettles at the top is arranged to be removed, to facilitate "dipping" the soap into frames. This method of emptying the kettles is adapted to thick soaps, which cannot be conveniently drawn from the bottom.

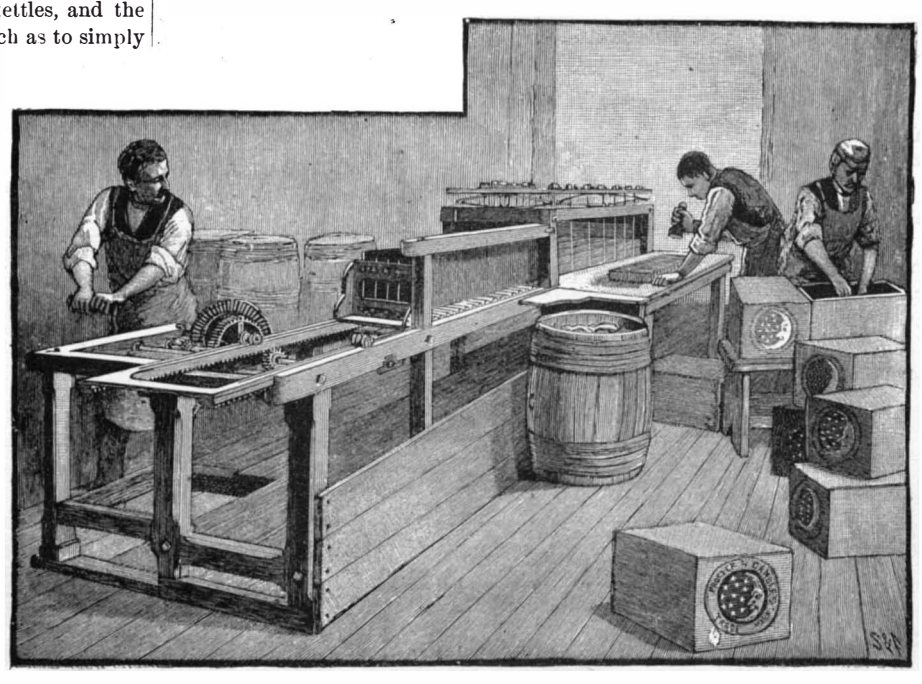
Now for the boiling process. A quantity of the lye, prepared as described, is allowed to run into the soap kettle, and when heated by steam is ready to combine with the oil, which is allowed to flow gradually upon the lye; more lye is added from time to time, as may be required, until the oil having combined with the soda, the whole has become a uniform mass of neutral or weak soap, dissolved in the water which had contained the soda. Salt is then freely scattered over the surface of the soap, and as it descends through it, it becomes dissolved in the water. This heavy solution precipitates to the bottom of the kettle, while the lighter soap, insoluble in salt water, floats above. This salt water, or "spent lye" as it is termed, is drawn off below. Repeated additions of lye, as mentioned before, are made, and after boiling and salting out, are drawn off, until the soap has become sufficiently strong, or, in other words, completely saponified. It is then purified by running into it a quantity of water, which has the effect of thinning it, so that any chance impurities and any excess of lye, after sufficient time has elapsed for settling, may be drawn from the bottom of the kettle, a very complete and distinct separation having been effected.

The value of washing out the surplus or "free" lye cannot be overestimated, for the free lye would attack the fiber directly, and thus burn or rot the clothing; it will also change the color and make white goods yellow, and burn and redden the hands. After boiling for a period longer, to evaporate the surplus water, the soap is then ready to be dipped over the side of the kettle or drawn from the bottom through a large pipe closed by a valve easily moved by a wheel. The cooling frames into which the soap is thus conveyed are iron boxes with wooden bottoms. These bottoms are provided with wheels, that the frame may be drawn to the proper place for filling, or cooling, or cutting. When the soap is sufficiently cool (from four to six days) it is "stripped," that is, the bolts which clamped the sides against the ends are withdrawn, and the sides and ends removed, leaving the cooled solid soap standing upon the bottom. It is now ready for the cutting machine. The cutting is done by wires drawn through the soap horizontally. This changes it into slabs the width and length of the frame and two or more inches thick. These slabs are placed, five at once, upon a "barring" table, where, by means of a small cog wheel made to revolve under a rack, the slabs are forced against and between wires kept taut, and are thus divided into long bars. By a slight change of a shaft, the soap cutter is enabled to push the long bars sidewise against another set of wires, which divide them into short or one-pound bars. The wires are set with perfect exactness, so that all the bars are of the same size and weight—one pound each. After being stamped by hand, the soap is packed into boxes that have the weight of the box marked on each. Then each box of soap is weighed, and the exact net weight is marked upon every box, and the soap is now ready for market. It will be seen that the cutting, stamping, and packing are simple and inexpensive; the useless expense of pressing into fanciful shapes and wrapping in bright-colored papers is saved. The public pay many thousands of dollars every year for pressing and wrapping soap, that are of no benefit to the soap or to them; in fact, it is done in most cases to make a poor article look attractive and more salable; the old-fashioned square-cut bars are the most economical.

One leaves the works of Procter & Gamble fully impressed with the fact that they know the wisdom and value of "what is worth doing at all is worth doing well." The thoroughness with which everything is done in the production of



STRIPPING THE FRAMES FROM THE SOAP.



CUTTING, STAMPING, AND PACKING SOAP.

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their mottled German soap shows careful and intelligent attention of skillful men, and the soap itself, being made by the most approved method and of the best of materials, thoroughly refined under their own supervision, is the very perfection of laundry soap, which water cannot penetrate and weaken, so that the last small piece is as good as a new bar; there are no acids or excess of alkali to injure the skin or clothing; in short, it is what all laundry soap should be—effective, durable, and economical.

A good article that has achieved success is always imitated, so it is but natural that there should be many imitations of Procter & Gamble's soap. The so-called mottled German soaps are made principally of grease, though some contain a small percentage of red oil, simply as an excuse for calling them "red oil soaps." They owe their mottled appearance to the impurities which are suspended in the soap; they are more or less offensive in odor on account of being made of grease. The process by which many of these so-called mottled German soaps are made is known as the "cold made" method, that is, the grease and lye are mingled together at the very moderate temperature of 110° Fah. There is some chemical action, but the result is strong in alkali, and at the same time greasy to the touch, and will not produce an abundant lather; the alkali not being thoroughly combined, but "free" to a great extent, will attack the fiber and burn the skin. Water will easily penetrate them, weaken the alkali, it being "free," and thus render the compound a greasy, putty like mass. There are many soaps of a pale straw color, very clear about the edges, and having the appearance of being made of wax. They are really very attractive in appearance, much more so than mottled German soap, which is, it is true, "homely but honest." Most of these clear soaps are made of tallow, and contain a large percentage of rosin and water. They shrink as they grow older, so, in order to preserve their shape, a considerable quantity of sal-soda is incorporated in them. The effect of this is that the excess of soda will eat or rot anything that has been washed with the soap.

The reader can form no idea of the vast number of compounds that are given to the public under the name of soap. Fully nine-tenths is not what the buyer has a right to expect. The materials used are full of impurities, and are too often made of decayed and putrid matter. Chemical science has shown how the noxious smells may be prevented, by the use of acids, etc., and by a plentiful addition of rosin to cheapen them, and perfume to hide the natural odor, they are passed out upon the unsuspecting purchaser. Fancy having your handkerchiefs, napkins, towels, and clothing washed with these compounds; yet there are many who will pay from ten to seventy-five cents for a small cake of toilet soap, but think anything is good enough for the laundry. A little more attention to the soap used in the laundry would insure greater healthfulness. When the pores of the skin are open by perspiration, the condition is favorable to absorbing into the system any impurities in the soap which the laundress may have failed to thoroughly rinse out of the garment, owing to the greasy and sticky condition of the soap used. Cases of fevers and diphtheria have frequently been traced to the use of soaps made of unfit materials, and cases of skin diseases without number to the same cause.

Not content with using poor materials, many soap makers use what are known as "make weights;" these are for the purpose of increasing the profit of the manufacturer, without equivalent value to the consumer. The principal "make weight" is marble dust, which costs but sixteen dollars per ton, or less than one cent per pound, so it is easy to see that the profit of the soap maker is greatly increased; for with three-quarters of a pound of soap a quarter of a pound of marble dust may be incorporated, and the compound sold as a pound of soap. Another adulterant is the "magnesia drier," which, in addition to being a "make weight," will help retain a large amount of water in the soap, and thus enable the manufacturer to sell water at the price of soap. A large volume might be written upon the adulteration of soap alone, but the brief description of soaps given in this little sketch is sufficient to enable the intelligent buyer to discriminate in favor of the best.

Awards to Workmen for Inventions.

The scheme of awards for inventions, instituted in August, 1880, by Messrs. William Denny & Brothers, shipbuilders, Dumbarton, and which has been regarded with considerable interest by very many employers of skilled labor, has just been amended and reissued to the workmen in their establishment. The results of the scheme as regards the number of workmen making applications or claims for inventions or improvements have been thoroughly satisfactory. The number of claims found valid, and the important nature of some of the inventions or improvements for which awards have been granted, have been such as to encourage Messrs. Denny to amend their scheme in one or two particulars whereby it may be rendered more effective. The maximum limit of award as laid down in the original scheme was £10; but it has been thought that the smallness of the sum may deter some from coming forward with ideas or with matured inventions of greater technical importance or value than have yet been elicited. Accordingly, Messrs. Denny and the committee of awards acting between employers and employed in this matter, have made a revised scheme wherein the fixed maximum limit of award is supplemented or superseded by the inducement of either (1) the granting of a greater award than £10, or, if considered worthy, (2), the award of £10, together with material assistance in securing letters patent for the invention. The following are the principal rules or features of Messrs. Denny's first scheme: 1. Any workman in our employ may claim an award from the committee on the following grounds: (*a*) That he has either invented or introduced a new machine or hand-tool into the yard. (*b*). That he has improved any existing machine or hand-tool. (*c*) That he has applied any existing machine or hand-tool to a new class of work. (*d*) That he has discovered or introduced any new method of carrying on or arranging work. (*e*) Or, generally, that he has made any change by which the work of the yard is rendered either superior in quality or more economical in cost. 2. In the case of a workman who is unable to test the merit of his supposed invention or improvement, either through inability on his own part to make the necessary experiments or to pay for the same, the firm, on the recommendation of the committee, may agree to bear the whole, or part, of the necessary expense; and if the invention should afterwards prove a practical success, an award will be granted accordingly. 3. On the establishment of a claim under the conditions above specified, the committee are to make an award, which is not to fall below £2, nor to exceed £10. Between these limits the award will be fixed by the committee according to the opinion they may form of the value of the improvement or invention for which claim has been made.

The clauses in Messrs. Denny's second scheme, embodying the changes in question, are as follows: 2. In the case of a workman who is unable to test the merits of his supposed invention or improvement, either through inability on his own part to make the necessary experiments or to pay for the same, the firm, on the recommendation of the committee, may agree to bear the whole, or part, of the necessary expense; or the committee will be at liberty to grant the free use of tools and appliances in the yard for this purpose, and if the invention should afterwards prove a practical success, an award will be granted. 3. On the establishment of a claim under the conditions above specified, the committee are to make an award, which is not to fall below £2, nor to exceed £10. Between these limits the award will be fixed by the committee according to the opinion they may form of the value of the improvement or invention for which claim has been made. But in the case of an invention or improvement being considered by the committee worthy of a greater reward than £10, they shall submit a report on the same to the firm, who may sanction either (1) the granting of such greater award than £10; or (2) should the invention be considered worthy of being protected by patent, an award of £10, together with the taking out at the firm's expense of provisional protection at the Patent Office on behalf of the inventor, all with a view to enable him either to dispose of his invention during the period of protection, or to make arrangements for completing the patent at his own or his friend's expense, provided always, that the firm shall have for all time coming the use of any such invention so provisionally protected at their expense, free from the payment of any royalty or patent rights that may be chargeable on the same, should the patent be completed.

Messrs. Denny & Co. Engineers, Dumbarton, have also, but for the first time, made offer of awards for invention to their workmen, and the scheme is in all respects similar to that just issued to Messrs. W. Denny & Brothers' workmen. The results of this renewed effort on the part of Messrs. Denny to quicken the inventive faculties and increase the technical proficiency of their workmen are sure to be waited on with interest. It is to be hoped, says *Iron*, that such measures may be productive of the good, which, in some quarters, is only hoped for through the increased institution of technical schools; and that the advantages accruing to the business of the firms in which the system has been introduced may speedily be such as to lead to its adoption in other places.

The Water of a Holy Well.

Professor Frankland has recently sent a letter to the London *Times* on the quality of a well regarded as sacred by Mohammedan pilgrims. The water appears to be even worse than that of many wells not considered sacred, but we hope our readers will take warning from this extreme instance of well pollution, and consider that it does not require contamination seven times worse than sewage to send typhoid and cholera into the houses of Christians, however it may be with Mohammedans.

Professor Frankland says: "The well is in Mecca; the water is regarded as holy, and large quantities are annually sent as gifts to all Mussulman countries. Most of the Mohammedan princes, especially those of India, have 'keepers of the well,' whose duty it is to send them annually water from the well.

"I have analyzed this water, and find it to be of the most abominable character. In fact, it is sewage more than seven times as concentrated as London sewage, and contains no less than 579 grains of solid matter per gallon. Knowing the composition of this water, and the mode of propagation of Asiatic cholera by excrementitious matters, it is not to be wondered at that outbreaks of this disease should often occur among pilgrims to Mecca, while it would scarcely be possible to provide a more effective means for the distribution of cholera poison throughout Mohammedan countries."

Mutilated Coins.

The Director of the Mint has authorized the purchase at the several mints at Philadelphia, San Francisco, Carson, and New Orleans, of mutilated and uncurrent United States silver coin of standard fineness at the rate of $1 per ounce Troy, when presented in sums of $3 and upwards.

Coins can be forwarded to those mints by registered mail or by express, charges prepaid, and the value will be returned at the seller's risk and expense by express, registered mail, check, or draft. Persons sending full weight United States subsidiary silver coins would receive, at the rate authorized, 80 cents per dollar of their face value, but, for mutilated coins, a less amount, proportioned to the deficiency in legal weight. At the rates paid mutilated silver coins will be worth at the mints: Per ounce troy, $1; per ounce avoirdupois, (about) 91 cents; per dollar, face value (approximately), 70 to 76 cents.

AGRICULTURAL INVENTIONS.

An improved harrow evener has been patented by Mr. Hermann H. Fischer, of Osage, Neb. The object of this invention is to promote convenience in harrows of collected rubbish, and in adjusting them to harrow the ground fine or coarse.

An improved corn planter and fertilizer distributer has been patented by Mr. William Cassill, of Hamden Junction, O. The object of this invention is to facilitate the simultaneous dropping of corn and distribution of fertilizers.

Mr. Abraham C. Scarr, of Maryborough Township, Ontario, Canada, has patented a harrow having such action that its teeth will not have a tendency to follow the edges of the furrows nor leave narrow unbroken ridges in the soil, but will cut the soil in all directions, causing complete pulverization of the soil and perfect covering of the seed without the necessity of cross-harrowing the field.

An improved grain header has been patented by Messrs. John W. Jory and Arthur B. Jory, of Salem, Oregon. The object of this invention is to remove the heads of the grain and leave the whole of the stalks standing, however much the said stalks may vary in length.

An improved cotton planter has been patented by Messrs. Anthony W. Byers and James C. Dorser, of Sherman, Texas. The object of this invention is to improve the construction of the cotton planters for which Letters Patent No. 233,725 were issued to the same inventors, October 26, 1880. The invention consists in the combination, with the slotted hopper bottom, of hinged and curved cut-offs and spring, whereby the escape of seed will be prevented, except as forced out by the prongs of the feed wheel.

Mr. William R. Berry, of Easley's Station, S. C., has patented an improved cotton planter and fertilizer distributer. In this machine the bearing wheel has peripheral U-shaped teeth, working in and through a slotted hopper bottom, for feeding the material to be sown.

An improved rocking churn has been patented by Mr. Otto Gentsch, of Souderton, Pa. The invention consists in a box provided with a transverse rack, with ice receiving chambers in opposite corners, and with rockets resting on wheels of a base, permitting the box to be rocked by means of its handles, and if the box is to be locked in a certain position a locking pin is passed through an aperture in the rocker into a correspondiug aperture in the base.

American Woolen Manufactures.

Abstract from Incomplete Returns of the Tenth Census (1880) *of Woolen Manufactures.*

	Establishments.	Sets of Cards.	Combing Machines.	Wool. In Condition Received. Foreign.	Wool. In Condition Received. Domestic.	Wool. Scoured.	Shoddy.	Cotton on Cards.	Cotton Warp.	Capital.	Value of Products.
				Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.		
Woolen goods	1,946	5,780	78	20,757,407	176,335,025	109,289.789	49,214,381	28 360,754	16.692,263	$93.911.061	$160,375,300
Hosiery and knit goods	356	615	3	440,758	7,966,137	5.827,692	1,739,947	20,756,151	266,511	15.111,626	28,253,683
Carpets	199	285	155	34,044,252	2,029,319	23,563,215	60,369		6,636,382	29,486,287	33,158,377
Felt goods	26	121	..	721,067	4,192,806	2,671,796	2,456,849	1,131,500	....	1,958,255	3.619 653
Worsted goods	75	258	281	15,687,815	23 646.511	25,025,235	190,800	1,757,842	5,178,952	20,411,043	33,359.941
Wool hats	41	302	..	1,865,513	6,074,471	3,535,279	1.248,952	185,400	....	3,605.830	8,496,845
All industries	2,643	7,361	517	73,524,812	220,244,269	169,913,007	54,911,298	52,191,647	28,774,109	164.484,105	267,263,799

NOTE BY MR. G. W. BOND.—It will be seen that 73,524,812 pounds foreign, and 220,244,269 pounds domestic wool, as purchased by the manufacturers, yielded to the cards 169,913,007 pounds, which indicates that of the whole wool consumed, at least ten to twelve million pounds must have been in the scoured condition, thus accounting for a consumption of at least 75,000,000 pounds foreign and 230,000,000 pounds domestic, in the usual marketable condition.

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The Oxyhydrogen Light.—De Khotinsky's Process.

The oxyhydrogen light was obtained first by an English naval officer, Drummond, who produced it by heating a piece of quicklime to incandescence in a hydrogen flame fed by a jet of oxygen. The *Drummond light* is very brilliant and possesses all the physical properties of sunlight, and the reason that it has not hitherto been applied for domestic and industrial purposes is owing to the high price of oxygen and the rapid destruction of the refractory material brought to incandescence in the flame.

It will be remembered that Tessie du Motay invented processes which, according to him, were to insure of a practical use of this kind of light. He *did* succeed in devising a mode of manufacturing oxygen economically, and one which allowed that gas to be obtained at quite a moderate cost price; but he did *not* succeed in solving the problem as to the preservation of the refractory material heated in the flame.

This scientist, after having made public experiments in the vicinity of the Passage Jouffroy, at Paris, discarded the use of the incandescent material, and contented himself with increasing the whiteness of the flame of illuminating gas and giving it brilliancy by injecting into it a pretty large quantity of oxygen. For this new system of lighting he employed a special burner formed of two concentric tubes, one of which served for conducting the carbureted hydrogen, and the other the oxygen. Some experiments were tried at the Place de l'Hôtel-de-Ville in 1868, but it was soon found that the light produced was not economical, and attempts in this direction were quickly abandoned.

This interesting problem of oxyhydrogen lighting has been again taken up within a few years past by Mr. De Khotinsky, a distinguished officer of the Russian navy. We were present not long ago at the experiments made in Paris, and shall describe the arrangements adopted.

De Khotinsky has succeeded in rendering the refractory substance of the Drummond light durable for quite a long use by means of a peculiar burner, which we represent in the accompanying Figs. 1 and 2. The pencil of refractory earth, whatever be the substance employed—lime or magnesia—is quite thin, and is supported at its upper extremity by two metallic pieces, *x* and *m*, tightened by a screw, so that it hangs vertically in the flame. The refractory material, being wholly immerged, becomes successively heated from bottom to top without there ever being any sudden difference of temperature between its different parts. The entire apparatus is affixed to a sleeve, *a*, and the burner, properly so called, is fixed to the upper extremity of two tubes, one of which conducts the combustible gas (illuminating gas, for example), and the other the oxygen. These two gases, which enter at the lower part of the apparatus, at *c d*, mix only at the upper part, *i*, of the burner. The flow is regulated by the cock, *o p*. The general arrangement of the different parts of the burner is shown in the section in Fig. 2. The conducting tubes are inclosed within a sleeve, *k*, which is itself fixed to a bent rod, *l*, to whose extremity is attached the crayon holder, *m*. The support, *s s*, is designed for holding a ground glass globe for dispersing the luminous rays, and which is not shown in the figures. The mixture of the two gases, when lighted at the upper extremity of the burner, gives a flame of small luminosity, but one whose very high temperature raises the refractory crayon to a *white heat*, and thus produces a brilliant and constant light. The same crayon will last for about fifteen days, when used every day. The burner consumes about 0·014 of a cubic meter per hour, and the same quantity of illuminating gas, and gives a light equivalent to that of 1·5 Carcels.

Mr. De Khotinsky proposes to prepare oxygen from permanganate of potash (either by the Du Motay process, or by a practical method that he is now studying), and to deliver it in a condensed state to dwellings by wagons. Each consumer will be provided with a reservoir made specially for the purpose.

We shall have nothing to say regarding the economical aspect of the question, as we have not studied it from that point of view; but we have seen the apparatus in operation, and can say that, as regards the quality of the light emitted, and its steadiness, the results are very satisfactory.—*La Nature.*

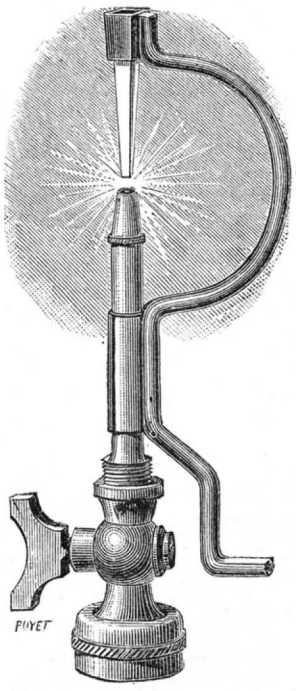

Fig. 1.—General View of the Oxyhydrogen Burner.

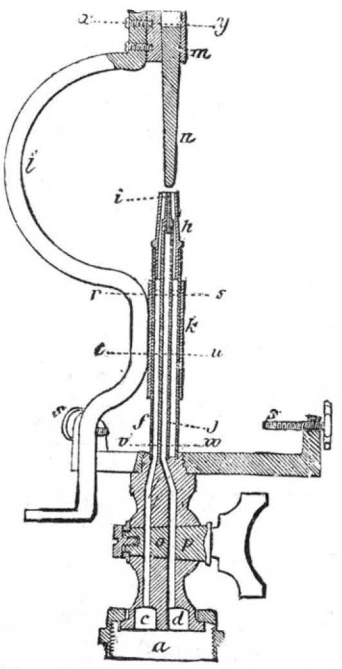

Fig. 2.—Vertical Section of the Burner.

Reactions for Iron and Copper.

For iron, the author finds the limit of visible reaction with potassium ferrocyanide 1 part in 500,000; with potassium sulphocyanide, 1 part in 1,600,000; and with tannic acid, 1 part in 350,000, the limit in this latter case being indistinct. For copper, with ferrocyanide, the limit is 1 part in 200,000 of water; with ammonia, 1 part in 25,000; and with potassium xanthogenate, 1 part in 900,000 of water. For silver, with posassium xanthogenate the limit is 1 part in 40,000 of water. For mixtures of ferric and cupric salts, with potassium ferrocyanide, the blue reaction was faintly perceptible in a mixture of 3½ vols. cupric and 1 vol. ferric solution, each containing 1 part metal in 100,000 water. With ammonia the blue reaction was first perceptible in a mixture of 1 vol. cupric and half a vol. ferric solutions, each containing 1 part metal in 10,000 water. If the iron is in larger proportion there appears merely a yellow coloration. On these limits of reaction the author founds an approximate method for the determination of iron and copper, the procedure being in principle the same as that above described for the determination of nitrates.—*A. Wagner.*

Detection of Glycerin.

To detect glycerin in the possible presence of sugar, the liquid in question it mixed with powdered slaked lime and an equal bulk of fine quartz sand, and evaporated to a paste on the water bath. When cold the residue forms a hard mass, which is pulverized and extracted with 80 to 100 c. c. of a mixture of equal volumes of absolute alcohol and ether in a small stoppered flask. On allowing the extract to evaporate, the glycerin is obtained free from sugar. If two drops of it are put in a dry test tube with two drops of phenol (previously liquefied), and the same quantity of sulphuric acid, and heated very cautiously over the flame, but so as to reach 120°, the formation of a solid brownish yellow mass is perceived. When cold a little water is added, and a few drops of ammonia, when the brownish yellow solid dissolves with a splendid carmine red color.—*E. Donath and J. Mayrhofer.*

The Lick Observatory.

According to a letter recently received in San Francisco by one of the trustees of the James Lick fund, it is thought that Alvan Clark, of Cambridgeport, Mass., to whom the contract for the Lick Observatory lens was awarded, will complete it in a shorter time than was expected. The contract calls for the glass to be finished and delivered by November 1, 1883, and it is thought that the lens will be constructed within that time. The price, as agreed upon, is $50,000, $12,000 of which was paid in advance on signing the contract. Two of the buildings at the summit of Mount Hamilton, the site of the Lick Observatory, have been completed—the first dome and the transit house. Within the first or small dome stands the twelve-inch telescope of Clark's and a four-inch comet-seeker, while the transit house, which stands a few feet east of the small dome, is furnished with time instruments, all in complete working order. The six-inch meridian circle is to stand a short distance east of the transit house. A series of photographs have been taken of the place, showing the observatory as it is at the present time, together with a section of the newly-completed road, with the temporary buildings now in use.

HERR P. VOLKMANN has in the *Annalen fur Physik und Chemie* compiled the results of experiments by Hagen, Matthiessen, Perre, Kopp, and Jolly, on the expansion of water, and has obtained the following mean results for the volume and density of water at various temperatures:

Temp.	Volume.	Density.	Temp.	Volume.
0 deg. C.	1·000122	0·999878	15 deg. C.	1·000847
1 "	1·000067	0·999933	20 "	1·001731
2 "	1·000028	0·999972	25 "	1·002868
3 "	1·000007	0·999993	30 "	1·004250
4 "	1·000000	1·000000	40 "	1·007700
5 "	1·000008	0·999992	50 "	1·011970
6 "	1·000031	0·999969	60 "	1·016940
7 "	1·000067	0·999933	70 "	1·022610
8 "	1·000118	0·999882	80 "	1·028910
9 "	1·000181	0·999819	90 "	1·035740
10 "	1·000261	0·999739	100 "	1·043230

The increase in the volume per degree of increase of temperature from the point of greatest density, 4°, is thus very rapid. For a rise of 1° from this, the volume increases by 0·000008, while from 99° to 100° the increase is about 0·000721.

A ROAD locomotive for war purposes was lately tried before Count Moltke. It weighed 28¾ tons, and drew easily 40 tons weight of guns mounted on their carriages fully equipped. Its maximum traction power is 150 tons, and its cost of maintenance is about 30 cents an hour.

Hardy Herbaceous Plants and their Best Modes of Culture.

The subject for the consideration of the Massachusetts Horticultural Society at a recent meeting, was "Hardy Herbaceous Plants and their Cultivation." The paper was presented by Mr. Warren H. Manning, and he said: It is evident that there is an increasing interest in the cultivation of hardy herbaceous plants. The use of tender plants and annuals for bedding purposes in summer decoration has been in vogue for about a quarter of a century, and they have almost entirely superseded hardy herbaceous plants for general cultivation; extremely brilliant and beautiful effects are produced by them in beds, ribbon gardening, and mosaic work, and it is not desirable that they should be set aside by anything less showy. But that hardy herbaceous plants should be used more generally in the place of tender plants and many annuals for general cultivation and to a considerable extent for bedding purposes, is desirable. The yearly renewal of tender plants requires a considerable expense every spring, or means for keeping plants through the winter, and a skill in propagation, preparation of the soil, and after cultivation to insure success, that most persons are unable to give. Hardy herbaceous plants, the first cost of which is but little more than tender plants in good garden soil, will live and blossom without fail year after year, and are continually increasing, so that a person with little trouble or expense can enlarge his own stock of plants and give to his neighbors. With a proper selection of one or two dozen species, flowers will be had from the time the ground is open in the spring until it is closed by the severe frosts. For the lover of flowers there are new beauties every day, and new flowers open for pleasure at short intervals. For the botanist a large collection of herbaceous plants is a valuable field for study and investigation; for the horticulturist there is an immense field for the introduction of new species, in the development of this class of plants by hybridization, by selection of the best seeds, and by careful propagation of sprouts and curious seedlings. In recommending and describing plants, Mr. Manning spoke as follows: The variegated day lily is strongly and beautifully marked with yellow, has a fine furred leaf, and stands the sun. The colors in this, as in all variegated herbaceous plants, can be prevented from fading to a great extent by picking the flower buds; the other varieties of the funkia do not stand sun well, but make nice beds in shady spots. The variegated symphium or comfrey has a bright yellow variegation with dark green, and forms a graceful tuft of large leaves that would be fine for the center of a bed. The Spanish valerian has a light glaucus green foliage and a profusion of carmine flowers through the summer. A bed of phlox amæna, bordered with phlox sublata having some of the choice varieties of common phlox, would furnish flowers from the first of May to the middle of October; the evergreen leaves of the low-growing phlox would keep it looking well the remainder of the year. Dicentra exemina has beautiful fern-like leaves and clusters of pink-purple flowers that are produced through the summer and into the fall. Dicentra spectabilis would make a fine center for a bed of the foregoing, and if it is cut back as soon as the flowers are developed it will flower from May to September. A bed of lilies having the surface of the ground covered with phlox sublata or other shallow rooting plants is effective, the foliage of the covering plants beautiful all winter, the flowers are their charms in spring, while the lilies are developing, and, above all, the surface plants keep the root and stem of the lilies cool in summer and protect them in winter. A handful of cold ashes placed about the lily bulbs when planted prevents decay and drives away insects. Grass beds are very graceful, and look well from early in the season until severe frosts. The wild garden is a desirable feature in an estate where there is plenty of room and a suitable place; here fine foreign flowers can be introduced among the already growing natural ones with fine effect. All the plants mentioned here require no special cultivation; they will all succeed in good garden soil, which should be well enriched when they are planted and when the roots are divided and reset, which should be as a rule in the spring and as often as every three or four years, or they will exhaust the soil about them, and begin to die out in the middle, or to disappear altogether. The beds should be kept free from weeds; many of the best plants will need staking; the stake should not be conspicuous, and a care should be had that the form of the plant is not disfigured by tying.

The End of a Famous Rose Tree.

Recently a high wind destroyed the famous "Gold of Ophir" rose tree, in Grass Valley, California. A Santa Rosa paper says that the stem was 26 inches around, and the shrub itself had grown over and around an oak 50 feet high, only stopping in its upward progress from lack of something to climb upon. When in full bloom nothing could be seen but a mass of golden flowers, forming an object of almost indescribable beauty and splendor. It was, as may well be supposed, the pride of its owner, who, when once before a strong wind partially uprooted the supporting oak, went to considerable expense to restore it to its upright position. But the recent injury was irremediable, and lovers of the beautiful in nature regret the loss.

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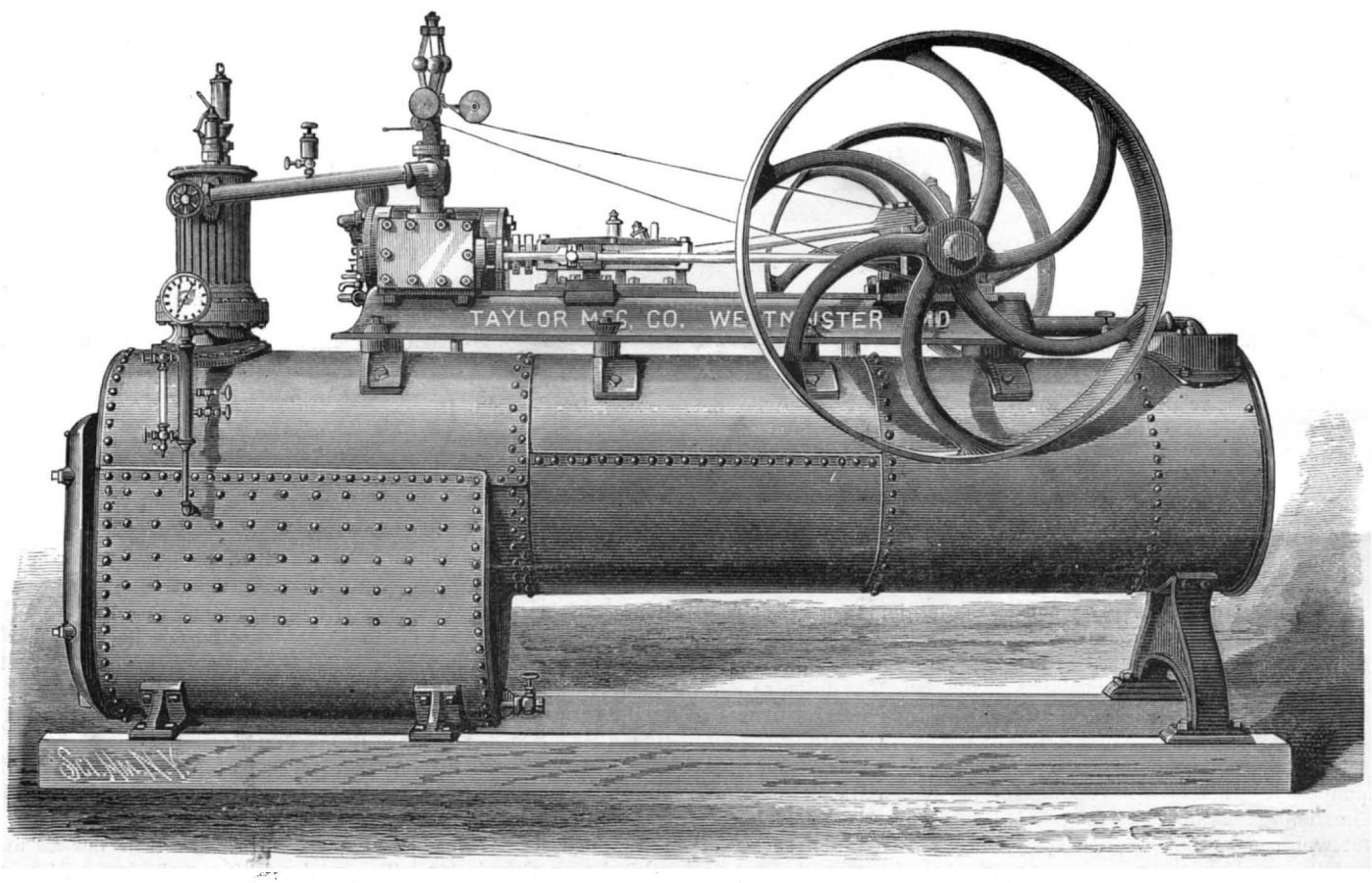
IMPROVED PORTABLE ENGINE.

The engraving represents a line of portable engines made by the Taylor Manufacturing Company, of Westminster, Md., from patterns formerly owned by the Utica or Wood & Mann Steam Engine Company, of Utica, N. Y. These engines have been in the market since 1857. The Taylor Manufacturing Company have purchased all of the patterns of the Utica Company, and have made many very decided improvements in details of construction while holding to the original well-tried principles of the engine.

This engine answers as a portable engine on the boiler, and it can be taken off and set upon a separate foundation and used as a stationary, and when so used it possesses advantages over the ordinary side crank stationary engine, as it has a compound or center crank supported by two ample bearings having gibs for adjustment. The journal boxes are of the kind known as the four-quarter box. They are bolted to the bed plate, which sustains the working strain of the engine and keeps all the parts in line. When the engine is used as a portable, the bed plate is secured to the boiler by means of stands or brackets, bolted to the boiler. The bolts that secure the frame to the brackets are made so as to allow for the expansion and contraction of the boiler without producing any strain on the engine bed. The guides are the usual locomotive pattern, and the crosshead has large and ample wearing surfaces. The connecting rod is made of the best hammered iron, straps being keyed and bolted and well fitted with gun metal boxes. The box in the crank end of the rod is made square to prevent rocking motion. The crank shaft, which is of good size, is forged of the best hammered steel. The fly wheels are heavy, and carefully balanced. Much care is taken in the casting of the cylinder so as to have good wearing metal. The piston is fitted with the usual packing, all joints of the rings being carefully ground and fitted so that the rings will adjust themselves to the surface of the cylinder. The slide valve is of the usual D-valve pattern, proportioned upon correct principles. The boiler is economical in the use of fuel, and the engine uses the steam to the best advantage. The Pickering governor used in connection with this engine is provided with a double valve that does not stick, and also with a stop motion that prevents the engine from running away in case the governor belt breaks. The speeder attachment is so arranged that the speed of engine can be changed fifty revolutions or less without altering the size of the pulleys or stopping the engine. The stop-motion is a very valuable feature, and will prevent such accidents as occur from the running away of the engine. The engine is fitted with a pump or inspirator as may be desired, and is provided with a heater in the bed plate directly under the cylinder. The exhaust steam enters the heater, heating the feed water and escapes through a pipe into the smoke-stack. The heater being contained in one end of the frame overcomes the objectionable features of expansion and contraction of the frame or bed, a common fault with many engines that have the heater running the whole length of the frame.

An exhaust nozzle of peculiar construction is placed on the end of the exhaust pipe in the smoke-stack, by which the effect of the escaping steam on the draught can be regulated at will and made to produce a very strong draught if desired. The boiler is made of the best Pennsylvania charcoal iron, carefully fitted, and double riveted where the shell is connected to the fire box; all flat surfaces are closely stayed; the holes punched so as to avoid the use of the drift pin; the crown sheet is stayed with crown bars upon the same principles now used by the best locomotive builders, and is provided with a safety fuse plug that melts out in case of low water, and puts out the fire, thus preventing the burning and injuring of the crown sheet and providing against explosion occurring from that cause. The flues are three inches in diameter, of the best American lapwelded make. The boiler is provided with a large dome, securing large storing capacity for dry steam, and has a steam blower for blowing fire; it is securely mounted on strong stands and sills, and is provided with three gauge cocks, glass water gauge, steam gauge, two top valves, a steam whistle, steam flue cleaner and fire irons, twenty feet of smoke-stack, and double spark arrester. The engine is provided with automatic glass oilers and cylinder lubricator, a full set of wrenches, oil can, and, in fact, everything that should be found on a perfect engine. This engine represents only one style or class of portable engine, in addition to which this company manufacture the well-known dry-steam engine, the Utica adjustable cut-off valve stationary engine, sawmills, and the clipper vertical engines.

For further particulars in regard to this engine address the Taylor Manufacturing Company.



PORTABLE ENGINE MADE BY THE TAYLOR MANUFACTURING COMPANY WESTMINSTER, MD.

Electric Lighting by Water Power.

The town of Godalming, in Surrey, has just been successfully lighted by electricity produced by the aid of water power, a method of generating the current not hitherto publicly adopted in England. Sufficient allowance, however, not having been made for the flooded state, and consequently sluggish flow, of the river Wey, after the late heavy rains, a steam engine has had to be pressed into the service as an auxiliary power. The water power required for driving the machine is obtained by two Poncelet water wheels at the Westbrook Mills, belonging to Messrs. Pulman. The steam engine is a semi-portable, by Messrs. Wallis & Stevens, of Basingstoke. One of Messrs. Siemens Brothers' generators is used—an alternate current dynamo-machine with an exciter absorbing about ten horse power. This machine supplies seven differential arc lamps and forty Swan incandescent lamps. The arc lamps are used for the main thoroughfares, and the Swan lamps for lighting the smaller streets; they are fixed in the ordinary gas-lamp posts. The current is conducted by bare copper wire attached by insulators to poles, like overhead telegraph wires, and no direct return wire is employed.

Of the arc lamps one is similar to those in the lower system of street lamps used in that part of the city of London lighted by Messrs. Siemens. The other arc lamps, of which there are three in the town, are of different mechanism, having three pairs of carbons, which burn with instantaneous changes, instead of two long carbons burning continuously. These lights, inclosed in square lanterns of clear glass, provided with reflectors, are placed on iron posts 22 feet high, and are stated to have an illuminating power equal to 300 candles. The Swan lights are estimated to give a light of about 15-candle power. Three of the arc lamps and fifteen of the Swan lamps are used in the illumination of Messrs. Pulman's Mills. Altogether about five miles of wire are used for the two systems of lights. The circuit of the differential arc lamps is about two and a half miles, the nearest of the lamps in the town being about half a mile from the mills, and the furthest being about a mile and a quarter distant. The work has been carried out by Messrs. Calder & Barrett, electrical engineers, of 154 Westminster Bridge Road, London. This firm will exhibit at the Crystal Palace Electrical Exhibition a turbine, to be worked by water supplied from the towers, that is to drive a dynamo-machine, which will alternately supply current for lighting and for the transmission of power.

RECENT INVENTIONS.

An improvement in horseshoes has been patented by Mr. James B. Finch, of Bozeman, Montana Ter. The object of this invention is to relieve the feet of horses from the jar or shock of traveling on hard or paved roads and also to provide for removal of the calks from the shoe. The invention consists in a flanged calk and rubber block combined with a recessed shoe.

An improvement in dynamo-electric machines has been patented by Mr. James B. Livingston, of New York city. This invention relates to the armature of dynamo-electric and magneto-electric machines; and it consists, essentially, in an armature of spiral or volute form, wound with wires or other electrical conductors having their plane of convolution at right angles to the plane of rotation of the spiral. The object of the invention is to increase the length of the body of iron composing the core of the armature without increasing the diameter or axial length of the armature, so that a single core may be divided up into a number of poles and nodal points, to secure currents of different potential by connecting the bobbins with each other and with the commutator in different ways.

Mr. Thomas Burnett, of Eureka, Cal., has patented an improvement in that class of breech-loading firearms in which the breech-block swings backward and downward. The improvement cannot be clearly described without engravings.

Mr. August Krause, of Salina, Kan., has patented improvements in that class of oil stoves in which the chimney flues for the lamps are formed in a water reservoir arranged over the lamps; and it consists in providing the water reservoir with a series of flues, one for each wick tube, and arranged each immediately over a wick tube.

An improvement in trucks has been patented by Mr. Benjamin S. Harrisson, of New Orleans, La. This improvement relates to trucks or wagons used for carrying heavy loads. As usually made, the hind wheels are of wider gauge, so that such wagons will not take the street railroad tracks, except at one side, in a manner that strains the running gear. The object of this invention is to secure uniform gauge of the front and rear wheels without sacrifice of width and other useful features of the ordinary construction, so that such wagons may take the track, a matter of importance in cities where street railways are numerous.

An improved loose pulley has been patented by Mr. F. L. Waltner of Hamilton, Ohio. The object of this invention is to facilitate shifting a belt from a tight to a loose pulley, and *vice versa*, and at the same time to prevent waste of power and the rapid destruction of the loose pulley. The invention consists in a fixed pulley within which slides a loose pulley which is adapted by its movement to carry the belt from the loose pulley on the fixed pulley.

A Two Mile Walk under Lake Michigan.

About the middle of January the old tunnel under Lake Michigan, for the water supply of Chicago, was pumped out for an examination of the masonry. On the 24th of January, Mayor Harrison, with the city engineer and several reporters, walked through the tunnel to the crib, a distance of two miles, on a tour of inspection. The bottom of the tunnel at the land end is sixty-eight feet below the surface of the earth, and the party were let down into the great hole at 2:15 P.M. With lighted miners' lamps they started on the journey, which was found to be laborious as well as uncomfortable, the water being ankle deep and the tunnel not quite high enough to permit a man to walk erect. The masonry was found to be perfect, and in commemoration of the trip, which took one hour and thirty-five minutes, the Mayor screwed a brass plate to the wall of the tunnel 3,000 feet from shore, bearing the inscription: "Water let in March 24, 1867. Pumped out January 18, 1882. Found in excellent condition." A climb of a series of ladders, seventy-two feet long, brought the party, well nigh exhausted, to daylight at the crib.

The English Channel Tunnel.

The construction of the proposed tunnel under the English Channel, between England and France, has been undertaken by the Southeastern Railway Company. It is promised that the undertaking will now be pushed to speedy completion.

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NEW INVENTIONS.

Messrs. Horace Massicks, of the Oaks, and Walter Crooke, of Duddon Villa, Parish of Millom, County of Cumberland, England, have patented an improved hot blast stove for blast furnaces. The object of this invention is to form a stove in which the greatest heat will always be maintained at the center.

Mr. Elias Durlach, of Brooklyn, E. D., N. Y., has patented an improved toy stove, constructed with a body having points upon its upper and lower edges, and the bottom and top plates having slits to receive the points and allow them to be bent down or clinched upon the plates, so that the stove can be easily, quickly, and cheaply made.

An improved whiffletree hook has been patented by Mr. Edward P. Barrett, of Holden, Mo. This invention consists of a ferrule or binding iron to be placed upon the single-tree, said iron or ferrule being provided with an enlargement upon the side of the single-tree, which is made with a narrow open slot, communicating with a larger hole or opening through the enlargement, and of a cockeye or loop to be attached to the trace, which loop is flattened or reduced in size at one point, so as to readily pass through the slot, the other parts of the loop being made too large to pass through the slot.

THE SYMBOLICAL SIGNS OF THE PLANETS.

GREBES AND THEIR NESTS.

Simply clothed birds need not envy the grebe its rich, satin-like plumage, for in consequence of its possession the poor grebe is hunted and slaughtered wherever it shows its face. The crested grebe was once fairly common in our own country; it now no longer ventures to appear, and only frequents solitary lakes in sparsely populated countries.

Our illustration is from a sketch supplied by an American correspondent, and shows one of their breeding places on a lonely lake. There they build their nests of any floating weeds and rubbish that they can collect, and moor it cleverly, with bits of sedge or long rank grass, to some water plant that grows from the bottom. It forms a little island home, and, as shown in the drawing, there are generally found numbers of these nests near together. Four and sometimes five eggs are laid, and when we learn that generally the water soaks up from the bottom, and that whenever absent the old birds always cover the eggs carefully with damp, moist weeds, we are rather astonished to hear they ever hatch at all.

The young are very prettily striped and marked, and at once take to the water, in and under which both old and young seem more at home than in the air itself, and it is in this continual diving that the suitability of their highly-polished feathers is so beautifully manifested, as it enables them to glide with lightning-like speed under the water, and turn and double with amazing quickness. The feathers which are peculiarly valued are those which come from the breast of this particular bird.—*Graphic.*

THE SYMBOLICAL SIGNS OF THE PLANETS.

Any one who has studied astronomy will recognize the following symbolical signs by which it is customary to represent the principal members of the solar system:

☉	Sun.
☽	Moon.
☿	Mercury.
♀	Venus.
♁	Earth.
♂	Mars.
♃	Jupiter.
♄	Saturn.
♅	Uranus.
♆	Neptune.

It is to be noticed that these signs do not represent sounds, like the letters of the alphabet. They designate an actual object, and consequently with the numerals 1, 2, 3, etc., are the only hieroglyphics, or sign writings, that exist in our language.

These astronomical signs, like the numerals, are employed in every European language without change in their form.

Each nation reads them in the language of the text; the sign, ♁, for example, would be called the "earth" in English, "la terre" in French, and "zemlya" in Russian.

The origin of these signs is not generally known, and is usually found only in the older astronomies. In Long's astronomy, published in 1764, is given the following account of the original forms of these symbols:

☿ is the caduceus, the snake-trimmed staff of Mercury; ♀ is a mirror with a handle; ♂ is a lance and shield; ♃ represents the first Greek letter in the name of Zeus or Jupiter; ♄ is a sickle; ☉ and ☽ are the disk of the sun and the moon's crescent.

The signs for the sun and moon are the most ancient. They may be seen in the Egyptian hieroglyphic writing, and in the second century, Clement, of Alexandria, used them. It is strange to find that the Chinese, also, in their oldest writings, more than forty centuries ago, used a circle to designate the sun and a crescent for the moon.

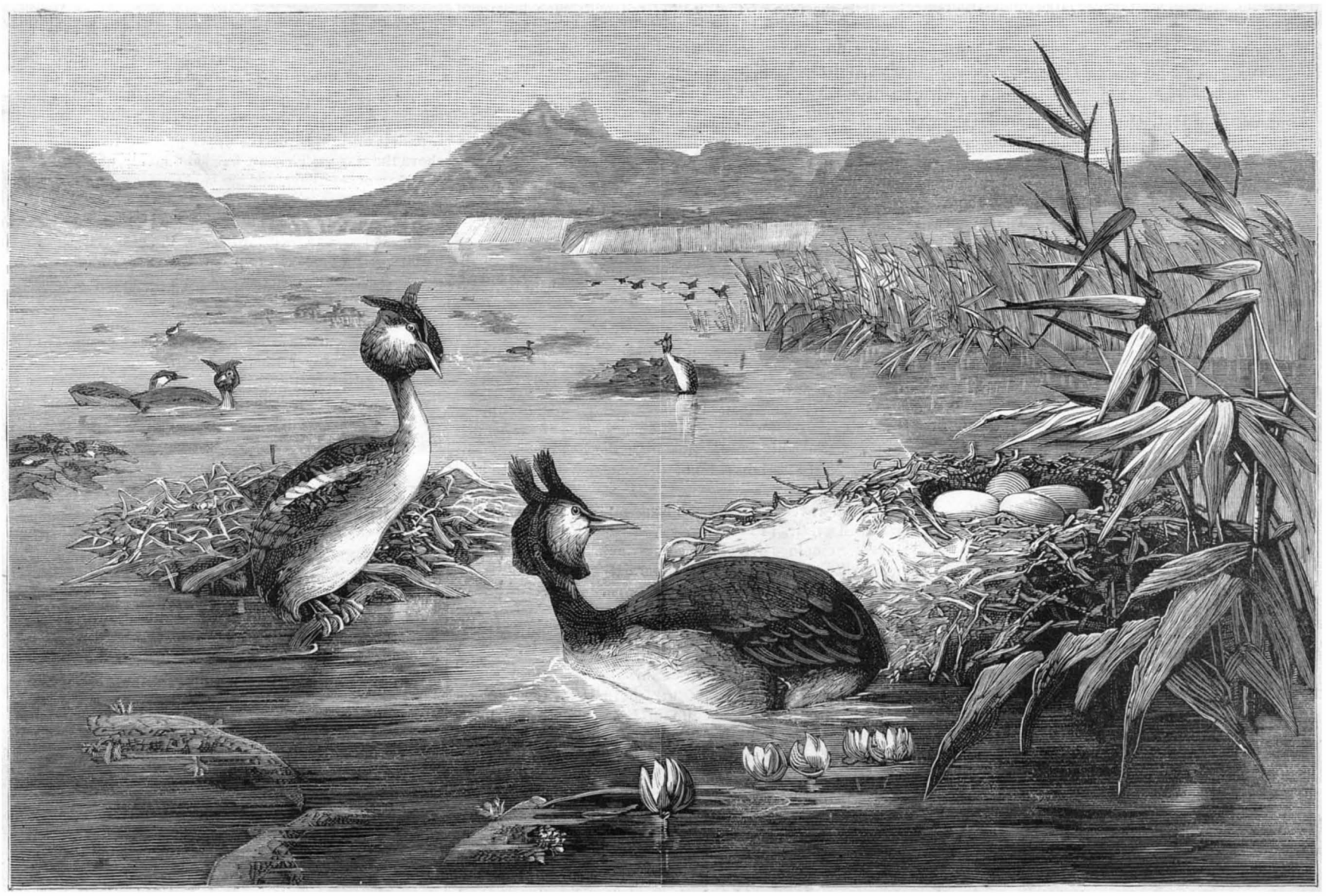
But the planetary symbols are much more modern; they were never used by the ancients, who always designated the planets by name. These signs did not appear until the cabalistic sciences were developed by the alchemists, who designated metals under the representation of planets, as every planet corresponded to some particular metal. Alexander Humboldt dates these signs from the tenth century.

The earth was not at first counted among the stars, and did not have any symbol until after the discoveries of Copernicus. The cross that surmounts the earth symbol, ♁, shows its Christian origin, dating from the sixteenth century.

The remaining signs are those designating the late discovered planets, Uranus and Neptune. The first, discovered in 1781, by William Herschel, is occasionally represented in Germany by a circle surmounted by a vertical lance, but as this is apt to be confused with the symbol for Mars, the initial H of the name Herschel is generally used in a slightly modified form, ♅.

Neptune, discovered by Le Verrier in 1846, was at first represented by the initials L and V in a cipher, but the trident, ♆, was soon substituted as more simple and convenient.

These are all the signs in general use for astronomical



GREBES AND THEIR NESTS.

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mechanics, as the asteroids are too numerous to be symbolically arranged. Any one desirous of pursuing the subject further can consult the works of Long, Lalande, or Von Humboldt, where they will find much curious and interesting information on this subject.—*La Nature.*

The Angora Goat.

Mr. Joseph P. Devine, a stock raiser in Texas, writes as follows to the National Association of Wool Manufacturers, Boston, Mass.:

There are millions of acres of rocky, hilly undergrowth of live oak in Western Texas and other States also, that will not support one sheep to twenty acres, one cow to forty acres, or one horse to fifty acres; in other words, that are utterly worthless for any use on God's green earth except for goats. Now if there is a good and sure sale for mohair, there is no doubt but the common goat can be made to produce, in five or six removes, a fleece equal nearly to any pure blood hair in luster and length, and in weight far more, by breeding from a pure bred billy every time and always. To sum up the advantages of goats over other stock, they can be herded with perfect safety and to advantage in flocks of 2,000; for I now have one herd of 2,050 graded Angoras, herded by one Mexican. They can be located in summer eight miles from their watering place, and drink once in three days, returning to camp same day—a great item in this dry country; they can be raised and thrive best on land worth fifteen to twenty-five cents per acre; they are subject to no disease whatever, that I know of; they will protect themselves, that is the grown, against wolves or dogs; and last, but not least, they come home five times in six, if lost on the range. Then there is not a more agreeable or pretty pursuit in the world than raising Angora goats. That you may not think I am too partial to Angoras, allow me to say I am breeding cattle, horses, and have 3,400 head of Merino ewes; and if I had a little more encouragement as to the future of the Angora, namely, regular sale and fair price for hair of first quality, I would, if forced to give up all my interest in stock except one, keep my pretty, intelligent, and valuable Angoras; and let sheep, hogs, etc., go to grass.

Trout Breeding.

Any person in possession of a spring producing a supply through the year of from one to one hundred square inches of pure water may grow, with right appurtenances and requisite knowledge and care, from 6,000 to 60,000 trout in one year, worth, at present prices for stocking ponds and streams, $100 per 1,000, or 500 to 50,000 to weigh a pound each, worth $1 per pound. The first thing necessary in trout culture is the construction of a pond, which must be fed by pure spring water, and must be kept clear and fresh. It is essential to the preservation of the trout that the temperature of the water be preserved at from 40° to 50°. The success attendant upon the culture of trout is instanced in the establishments of Seth Green, Livingston Stone, and other noted fish culturists, who realize large profits from this source.—*Sea World.*

Fires and Firemen in London.

The report of the Chief of the London Fire Brigade reports 2,376 calls for the year 1881. Of these 240 were false alarms, 145 proved to be only chimney alarms, and 1,991 were calls for fires, of which 157 resulted in serious damage and 1,824 in slight damage. The fires of 1881 compared with those of 1880 show an increase of 120, and compared with the average of the last ten years an increase of 351. The number of fires in the metropolis in which life was seriously endangered was 107, and the number in which life was lost 29. The number of persons seriously endangered by fire was 154, of whom 114 were saved and 40 lost their lives. The number of journeys made by the fire-engines of the fifty-three land stations was 28,441, and the total distance run 62,904 miles. The quantity of water used for extinguishing fires was 17,232,682 gallons, or about 76,931 tons. The strength of the brigade at present is as follows: 53 land fire-engine stations, 11 movable land stations, 121 fire-escape stations, 4 floating stations, 3 large land steam fire-engines, 35 small land steam fire-engines, 78 six-inch manual fire-engines, 37 under six-inch manual fire engines, 137 fire-escapes and long scaling ladders, 3 floating steam fire-engines, 2 steam-tugs, 4 barges, 29 hose-carts, 15 vans, 2 trollies, 53 telegraph lines, 7 telephone lines, 7 fire-alarm circuits with 44 call points, 536 firemen, including chief officer, second officer, superintendents, and all ranks. The report states that the fire-alarm circuits have been of great service, though the men are often harassed by false alarms through them.

The Highest Railway Bridge in the World.

The Erie Railway extension from Bradford to Johnsonbury, Pa., crosses the deep valley of the Kinzua Creek about thirteen miles from Bradford. Here the company are building a bridge which, when completed, will be the highest railway bridge in the world. The bridge will be somewhat over 2,000 feet long, and will consist of twenty-three spans of 60 feet each, resting on piers of stone and iron. The greatest depth of the valley at the point of crossing is 300 feet. The piers will be 40 feet long and 110 feet wide at the base, tapering to a width of 12 feet at the top. The iron work will weigh 2,500 tons, and the masonry will measure 2,200 cubic yards. It is expected that the work will be completed by June, 1882, at a cost not far from $300,000.

It is claimed that this is the highest bridge in the world resting on piers. The Kentucky River bridge is 276 feet high, the Great Peruvian Railway bridge is 235 feet, the Portage bridge, on the Erie's main line, is 234 feet, and the Niagara suspension bridge is 275 feet.

MISCELLANEOUS INVENTIONS.

Mr. George H. Beck, of New York city, has patented an improved apparatus for spreading varnish, paint, etc., in a uniform layer, for the purpose of facilitating applying the varnish or paint on the printing surface of the blocks used in printing hand-made wall papers. The invention consists in an endless belt or apron passing over suitable rollers and over a vertically adjustable cushion box, which is combined with mechanism for raising it when the machine stops, so that the wall paper printing blocks can be placed on this apron for the purpose of transferring some of the varnish spread on the apron by a spreading roller (dipping into a varnish box) upon this wall paper printing block.

Mr. Charles H. Henderson, of Philadelphia, Pa., has patented an improved waste water pail provided with a convex lid resting on a series of brackets projecting from the inner surface of the pail and united by a wire, this lid being so much smaller than the pail that an annular space will be formed between the edge of the lid and the inside of the pail; through this annular space the water flows and then runs down on the inside of the pail without dripping or splashing.

In hydraulic rams as ordinarily made it is difficult to adjust the valve screw with delicacy, and, furthermore, the constant pulsation or jar of the outlet valve tends to "back out" the screw, so that the tension of the spring is reduced and the effective working of the valve interfered with. Mr. Henry F. Morrow, of Chester, Pa., has patented an improvement in hydraulic rams which obviates this difficulty. In horizontal hydraulic rams of ordinary construction air accumulates in the air chamber until the water with difficulty gets access thereto, and consequently the ram labors in its work and does not operate effectively. To remedy this defect an open tube is introduced down through the top of the air chamber to a little below the water level therein. This tube serves as the water discharge pipe, as well as to prevent the excessive accumulation of air in the chamber.

An improved sash-fastening device, which can be easily applied to window sashes, has been patented by Mr. Silas G. Austin, of Boston, Mass. The construction of this fastener is such that it can be readily fixed to two light sashes opposite their center vertical dividing rails, in which position a sash fastener properly belongs to preserve the symmetrical appearance of the window; and instead of fixing a locking plate to the upper face of the meeting rail of the upper sash by small screws, which may be easily forced off, the construction of this fastener is such as to admit fastening it to the face of the meeting rail with such large and strongly holding screws that any attempt to force it off by prying up the lower sash would most likely demolish the glass in the sash and alarm the occupants of the house.

Mr. John F. Petri, of Midland Park, N. J., has patented a coupling by means of which wires can be joined more expeditiously and with less labor and expenditure of force than by the usual method of twisting them about each other. The invention consists in coupling the wires by means of a semi-cylindrical metallic plate having two radial holes to receive the bent ends of the wires. The wires, having their ends bent at right angles, are laid in the plate with their ends entered into the holes therein, and the said plate is then, by means of a hand vise or other suitable tool, clasped tightly about the wires, so as to form a closed sleeve about the point of union.

An improved combined hoe and cutter has been patented by Mr. Parrott M. Hardy, of Aurora, N. C. When the implement is to be used for cutting purposes the blade is to be detached from the end of the handle, which is easily done by simply partially removing a pin and sliding or tipping the blade forward and placing it upon the side of the handle; in this position pins projecting from the handle fit into the notches in the upright sides of the blade, and serve to hold the blade in place.

An improved safety attachment for elevators has been patented by Mr. Frank T. Ward, of New York city. This inventor employs a toothed eccentric held out of engagement with the rack, when in its normal position, but is released when the rope on the elevator car breaks.

The Explorer Leichhardt's Journals.

There seems to be no reason for doubting the reported discovery by Skuthorpe of the journals of the explorer Leichhardt, who lost his life in Eastern Australia many years ago. Baron Müller, of Melbourne, who for more than thirty years has been an ardent promoter of the search for the relics of Leichhardt's expedition, writes to Dr. Behm, at Gotha, that Skuthorpe probably continued Hume's routes until he successfully reached the most western stations in the interior of Eastern Australia. Here he found the journals of Leichhardt and Classen, and gained possession of them in return for a small present to the holders. Both journals are said to be in English and well preserved. Classen confirms the report of Hume's nine weeks' stay with him, and records how the expedition suffered terribly from want of water. He was sent by Leichhardt in search of water, and on his return, two days later, he found Leichhardt dead. Afterwards Classen fell into the hands of the aborigines, who carefully watched him. Once he attempted flight, but was brought back and severely beaten. In 1877 Classen felt death approaching. He revisited the place where Leichhardt's journal, enveloped in leather, was hidden, and added to it part of his own journal.

Proposed New Patent Department.

To the Editor of the Scientific American:

The bill Mr. Phelps presented December 13, 1881, is calculated to supply a desideratum long felt and not disputed by those best qualified to form an opinion. It is substantially what has been recommended to the consideration of Congress by almost every succeeding Commissioner of Patents and repeatedly urged by you, and is, in brief, simply a permission to the one self-supporting bureau to extend its revenue on means, perfectly understood and defined, for the proper administration of its duties. One of the most important of these means is a completely indexed digest of industrial art. With such a repository at their disposal inventors (who constitute the principal contributors to the fund), would be able to concentrate their energies on untrodden fields of discovery, by informing themselves of what others had already accomplished. Manufacturers and users of machinery could at a glance, so to speak, inform themselves of the best appliances. The community at large, which is the chief beneficiary of invention, would in this simple act of justice be largely benefited by the increased discrimination exercised in patent grants.

G. H. KNIGHT.

Cincinnati, January 30, 1882.

Rapid Growth of New York.

The annual report of the City Inspector of Buildings shows that during the past year plans for 2,682 buildings, to cost $43,391,300, were filed at the Building Bureau. In 1880 the number of new buildings erected was 2,252, at a cost of $29,115,335. There were more buildings erected last year, and their estimated cost was greater than in any previous year.

Of last year's buildings, 940 were dwellings, whose estimated cost was $12,521,500; 356 were flats, costing $8,080,480; 808 were tenements, costing $8,284,100; 8 were hotels, costing $923,700; 123 were stores, costing $3,643,500; 23 were to be used for office purposes, costing $4,453,500; 116 were factories, costing $1,723,935; 13 were places of amusement, costing $1,196,300; 6 were churches, whose aggregate cost was $216,000, and 6 were school houses, that were to cost $217,000. One thousand four hundred and ninety-seven plans for alteration of existing buildings, at a cost of $4,142,070, were filed. Two thousand two hundred and twenty-five buildings were found to be unsafe, and 2,229 were either pulled down for this cause or strengthened.

Self-Acting Fire Apparatus.

Prof. Obernien proposes the following ingenious and simple arrangement for theaters: Cords of hemp are stretched from left to right across the upper part of the entire space above the stage. They are fixed at one side, and on the other they pass over pulleys, and are kept tight by means of weights which are surrounded with cases. Perpendicularly under the weights, at the bottom of the cases, is a button, which, if pressed downward, closes the circuit of a powerful battery. If a flame rises up it catches and ruptures one of these threads, when the weight falls in the same moment upon the button and closes the battery. The results are: 1, a telegraphic message to the nearest station of the fire brigade; 2, a fireproof curtain is let down by a mechanism set in motion by a suitably arranged electro magnet; 3, an electro-magnet opens a large ventilator in the roof above the stage for the escape of the flames and smoke; and 4, a reservoir is opened which lays the stage under water.—*Chemiker Zeitung.*

Tan Bark for Exportation.

The demand for tan bark in Europe is urgent, but the price is not sufficient to make the exportation of bark in bulk profitable. It is now proposed to grind and compress the bark where it is abundant, and ship it in kegs or half barrels. For this work a steamer has been built on the Ohio, to be used on the upper waters of the Tennessee River, along whose shores tan bark is plentiful and cheap. The steamer carries special machinery for grinding and compressing the bark.

The St. Lawrence Tunnel.

The railway tunnel under the St. Lawrence at Montreal, Canada, is to have the following dimensions: Entire length, about 21,700 feet; open cuttings on Hochelaga side, 2,5[illegible]0 feet, and on the Longueuil side, 4,220 feet; actual length of tunnel proper, 14,980 feet. It is to be 26 feet wide inside and 23 feet high. It will be lined with brick masonry throughout, except the fronts, which will have façades of stone. The arch will vary from 20 to 30 inches in thickness, according to the character of the ground to be supported.

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Discovery of a New Constituent of the Blood.

The discovery of a new and important constituent of the mammalian blood has, says the London *Lancet*, just been announced by a distinguished investigator of blood formation—Professor Bizzozero, of Turin. This new element is not the same as the invisible corpuscle of Norris, but presents nevertheless somewhat similar characters. If the course of the circulation is watched in the small vessels in the mesentery of chloralized rabbits and guinea pigs, there are seen, besides the ordinary red and pale corpuscles, third elements —very pale, oval, or round disk-shaped or lenticular bodies, one-half or one-third the diameter of the red corpuscles, among which they are scattered. "Blutplattchen," Bizzozero proposes to call them. They have hitherto escaped notice, probably because they are so colorless and translucent, less numerous than the red, and less visible than the white corpuscles; and on account of the difficulty of observing the mammalian blood in the course of the circulation with a high magnifying power. They are to be observed also in freshly drawn blood, for the most part aggregated around the colorless corpuscles, or, ascending to the upper layer, they adhere to the cover glass. They change, however, with great rapidity, rapidly become granular, and appear to be the source of the small granule masses which have been described by many observers. The corpuscles can be preserved unaltered in form for more prolonged examination by certain reagents, as, for instance, by a solution of chloride of sodium tinted with methyl-violet. They are to be found also in human blood, but they undergo alterations with extreme rapidity, and the best method of observing them has been found to be by placing a drop of the above solution over the puncture, and then squeezing the blood out, and immediately examining it under the microscope.

Bizzozero has been unable as yet to ascertain anything regarding the origin of these elements. It is exceedingly improbable that they are in any way derived from the ordinary colorless corpuscles, because they possess a very definite and characteristic form, and the leucocytes contain no element from which these objects could be derived. A comparison between the blood in the vessels and out of the body thus clears up the origin of the granule heaps, which some regard as products of the destruction of leucocytes, and others, as Hayem, ascribe to changes in peculiar flat corpuscles. The latter view is undoubtedly correct, although Hayem does not seem to have observed these elements in the circulating blood, since he describes them as biconcave disks which are transformed into red corpuscles, and calls them "hæmatoblasts." The objects regarded by Bizzozero as the source of the granules possess no stroma, and never contain hæmoglobin; they differ therefore from the hæmatoblasts of Hayem.

The new elements seem to play an important part in the functional alterations of the blood. They are increased in certain morbid conditions—as, for instance, after bleeding—and play an important part in the production of thrombi, They constitute the chief part of the white clots in the mammalia, since they give rise to the granular material which is seen between the pale corpuscles, and which has hitherto been ascribed to the degeneration of fibrin. In the process of coagulation these elements appear to exert the influence which has been attributed by Mantegazza and Schmidt to the colorless corpuscles. Schultz, Ranvier, Hayem, and others, have noted that the reticulated threads of fibrin often present at their junction these groups of granules, and hence inferred that the latter were produced by the degeneration of the fibrin. Hayem, however, found that certain fluids which hinder coagulation preserve unchanged the form of his "hæmatoblasts." It will also be remembered that A. Schmidt asserted that the coagulation of the blood is effected by the white corpuscles, which by their destruction yield the granules, and so constitute a considerable part of the substance of the clot. Bizzezero, however, now urges that the formation of the clot is due not to the white corpuscles, but to these new elements. He has never been able to satisfy himself of the wholesale destruction of white corpuscles assumed by Schmidt. Leucocytes are comparatively few in the circulating blood, and he could never observe any destruction of them after the blood was drawn, provided it was mixed with an indifferent fluid, such as a saline solution. The time at which coagulation occurs in a given drop of blood corresponds closely to that at which these new elements present the degenerative changes. The fluids which retard or prevent coagulation—solutions of carbonate of soda or of sulphate of magnesia, for instance—also hinder the granular transformation of the new corpuscles. The indifferent solution of chloride of sodium does not preserve them, but one to which methyl-violet has been added does so. With the former the blood coagulates in a quarter of an hour, with the latter it remains liquid for twenty-four hours. If a vessel of a living animal is included between two ligatures, the blood within it remains liquid for hours, and during the whole time these elements preserve their characteristic form, although in blood outside the vessels they undergo degeneration in a few minutes. If blood is "whipped" and the fibers employed are withdrawn before coagulation commences, and are then immersed in a liquid capable of preserving the new elements unaltered, it will be found that they are covered with a thick layer of the new elements, among which are very few white corpuscles. If the whipping has been continued longer, these elements are found to have undergone degeneration and to remain on the layer of fibrin. From these facts it follows that whereas the ordinary white blood corpuscles present no noteworthy changes at the commencement of coagulation, these new elements are considerably altered, and where they adhere, there the fibrin is deposited, and, finally, that all agents which hinder their transformation retard also the coagulation of the blood. The evidence is thus very strong that this coagulation—that is, the formation of fibrin—takes place under the direct influence of these corpuscles.

Action of Coffee and Sugar in Digestion.

M. Leuen makes a report before the Paris Biological Society of the effects of these articles of food, in connection with Dr. Semerie. There is great diversity of opinion on these subjects. Some, as Trousseau and Pidoux, consider coffee an excellent digestive. Others, on the contrary, consider it very injurious.

M. Leuen thus writes: He mixed 30 grammes of coffee in 150 grammes of water, for a dog, which is killed three hours after. The mucous membrane of the stomach is found pale, discolored, and profoundly anæmic. The vessels on the internal surface, as well as those in the periphery, are contracted. There remains 145 grammes of the mixture undigested, and the stomach digestion diminished, because the contraction of the vessels, and the consequent anæmic condition of the mucous membrane, prevent the secretion of the gastric juice. The abuse of coffee will produce dyspepsia. Thus the English and the Dutch, who drink freely both of tea and coffee, are very dyspeptic. Coffee increases the cerebral functions, an effect useful, agreeable, and innocuous.

Sugar has been denounced by modern chemists as a substance whose effects on dyspeptics are deplorable.

Dr. Leuen does not partake of these fears. He cites the case of a dyspeptic doctor, who for twenty years had a terror of sugar, but who now consumes 120 grammes (3¾ oz.) of sugar daily, without inconvenience. He followed similar experiments with sugar. A dog ate 80 grains of sugar with 200 of other food. Six hours afterwards its stomach showed little food. The mucous lining of the stomach was red and highly congested. The congestion of the liver was notable. If one opens an animal after eating 200 grains of food and no sugar, 90 to 100 grammes of food is undigested. Sugar, then, favors the secretion of the gastric juice. Coffee sweetened loses part of its defects.—*Le Medecin Practicien.*

Changes Accompanying the Ripening of Certain Plants.

BY P. P. DEHERAIN AND BREAL.

Deherain explains the loss in weight of dry matter which occurs during the maturation of the seed in the cereals and other plants. The formation of the seed involves the transport of carbohydrates and nitrogenous bodies from one part of the plant, to be afterwards stored up in another part. In the case of the carbohydrates, this transport does not necessitate any loss in weight, since they exist in the form of reserve materials (starch, etc.), which take no active part in the phenomena of growth. But in the transport of nitrogenous bodies a certain quantity of protoplasm has to disappear from the living cells in the form of asparagine, to reappear in the seed as legumin, glutin, etc. Assimilation then ceases in the cells thus deprived of protoplasm, but oxidation still goes on, and thus a loss of weight is produced. The authors distinguish three cases. In those plants which flower rapidly and bear simultaneously a large number of flowers in proportion to the size of the plant (*Sinapis nigra, Colinsia bicolor*), there is always a loss in weight of dry matter; assimilation suddenly ceases throughout a large portion of the plant, but oxidation still goes on. In plants which do not produce many flowers at once, nor in too great proportion to the leaves, ripening is accompanied with only a temporary loss of weight; a sufficient number of chlorophyl granules remain intact to carry on the work of assimilation, which proceeds with renewed vigor after the seeds have ripened (*Eschscholtzia californica, Delphinium ajacis*). When the flowers are very few and the leaves numerous (*Papavera somniferum, Hesperis maritima, Silene pendula*), the dry matter increases in weight during the ripening of the seed.—*Jour. Chem. Soc.*

Permanent Magnetism of Steel at Different Temperatures.

The steel rods were cylindrical, and passed in a vertical direction through an induction coil. The influence of the earth was evanescent. In order to assume the permanent magnetism corresponding to a certain temperature, the rod requires a somewhat longer time for cooling than for heating. The greater the total decrease of the magnetism, the longer are these times. The number of the successively following heatings and coolings by which the rod is brought to a permanent condition is about proportional to the permanent decrease of the initial magnetism. The greatest loss is between 170°–200° C. Every shock effects a decrease of magnetism when the rod is hot. After repeated agitations and heatings the rod undergoes no permanent changes. The distribution of the magnetism was likewise examined in long rods, according to the methods of Van Rees. In his formula for the moment, M, at points distant, x, from the end, $M = a\,(1 + k^{-1} - k^{-x} - k^{(1-x)})\,l\,x$, where l denotes the length of rods and a and k are constants, it appeared that under certain circumstances k is constant at all temperatures for the same magnet, while a varies with the temperature. Jamin found a depend merely on the nature of the rod. Below 180° C. the distribution of the magnetism varies no longer; *i. e.*, the value of k remains constant, and the neutral line lies always in the middle of the rods. Above 180° C. the same thing takes place if the rod has been repeatedly heated before being magnetized. But if it has been magnetized before the heatings and coolings, k varies with the temperature, and the neutral line is displaced towards the north pole, so that austral magnetism extends over two-thirds of the rod.—*G. Poloni, in Wiedemann's Beiblätter.*

How to Make Brick Walls Water-tight.

The Sylvester process was successfully applied to the interior walls of the gate houses of the Croton reservoir in the Central Park in this city, in 1863, on the advice of the late William Dearborn, C. E., and under the immediate supervision of George S. Greene, Jr., C. E., now the Engineer in Chief of the Department of Docks.

The process and its results in this case are described fully by Mr. Dearborn in a paper read by him before the American Society of Civil Engineers, May 4, 1870.

The process consists in using two washes or solutions. The first composed of three-quarters of a pound of castile soap dissolved in one gallon of water, laid on at boiling heat with a flat brush. When this has dried, twenty-four hours later apply in like manner the second wash of half a pound of alum dissolved in four gallons of water. The temperature of this when applied should be 60° to 70° Fahr. After twenty-four hours apply another soap wash, and so on alternately until four coats of each have been put on. Experiments showed that this was sufficient to make the wall water-tight under forty feet head of water.

At the time of application the walls had been saturated and the weather was cold. The gate chambers were covered over and heated thoroughly with large stoves. The drying, cleaning the walls with wire brushes, and applying the mixture, took ninety-six days. Twenty-seven tons of coals were used for the drying and one ton for heating the soap solution. 18,830 square feet of wall were washed with four coats. The drying and cleaning of the walls cost six and a half cents per square foot, and the plant, materials, and labor of applying the wash cost three and three-eighths cents per square foot.

Stoves and Lamps in Railway Cars.

It is natural, says the *National Car Builder*, when a railway accident occurs attended with loss of life by the burning of passenger cars, that there should be a good deal of animadversion on the methods of heating and lighting in which the conflagration originated. The views of the great majority of people, however, who talk and write under the spur of a sudden calamity, are apt to be crude and ill considered. They assume that something is imperfect from somebody's fault, and that the stoves and lamps might have been better and safer had proper care been exercised in their selection. Little heed is given to the fact that railway men and inventors have for a long time been engaged in devising means for warming cars without the actual presence of fire within the cars, and for lighting them without danger of conflagration under any circumstances. The fact that these efforts have thus far been unsuccessful is an evidence of the practical difficulties of the problem. It is a favorite idea with many that cars can be heated by steam from the locomotive, or from a special generator placed in the baggage car. As regards the first method, it is impracticable without such a draught on the capacity of the engine as would necessitate slower and lighter trains; and as to the second, it has been tried again and again, if we mistake not, and found to be beset with such serious mechanical difficulties as to render it impracticable except in its application to special trains.

It is safe to say that a dozen accidents a year like the recent one on the Hudson River road would not lead to the immediate disuse of stoves for car heating; but it would most certainly lead to more effective means for the prevention of such collisions between trains. There are many excellent car stoves—safety stoves, so-called—and they are none the less worthy of their name, even if they happen to be broken in a crash, the force of which no structure of a similar kind could be expected to resist. There is a limit to the usefulness of almost everything. Make a car stove of the best wrought iron of any desired thickness for resisting shocks, it must have a door, and perhaps two of them, and these must be open and closed several times a day to feed and keep up the fire. The chances are, that under such circumstances, they would not always be in trim for a first-class telescoping collision, so as to keep the live coals from spilling out, especially when such collisions almost always occur with little or no warning.

As regards lighting, we doubt whether any safer material can be used than heavy mineral oils, unless it might be electricity, which will perhaps be utilized for car lighting at some future time. These oils are not explosive, and are certainly less dangerous than coal gas. There is no instance that has come to our knowledge in which they have set fire to cars. The shock of a collision, the upsetting of a lamp, or an excess of oil forced through the wick, extinguishes the flame.

A WOMAN who carries around milk in Paris said a naive thing the other day. One of the cooks to whom she brought milk looked into the can, and remarked with surprise: "Why, there is actually nothing there but water!" The woman, having satisfied herself of the truth of the statement, said: "Well, if I didn't forget to put in the milk!" —*Medical Advance.*

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The Fastest Boat in the World.

A new steam torpedo boat, 100 feet long, 500 horsepower, has lately been tried in England, the officially recorded maximum speed attained being twenty-six miles an hour. This is believed to be the fastest vessel afloat. The vessel is able to carry coal and supplies enough to steam 1,000 miles and remain at sea for a week. She has two bow tubes for delivering torpedoes. With a fleet of such boats in readiness for action it would seem to be not a difficult task to defend maritime cities like New York and Brooklyn from the approach of the most powerful invading fleets. The new steamer is thus described by the *Engineer:*

On Wednesday, January 18, Admiral Brandreth, Controller of the Navy, Messrs. Morgan, Butler, and Allington, of the Admiralty, and several naval *attaches* of European powers, visited a torpedo boat brought up to Westminster Pier for the purpose by Mr. Yarrow, of Poplar. This craft may be regarded as the latest example of torpedo boat construction, and thus deserves more than a passing comment.

The experience acquired by Mr. Yarrow during years of successful construction of this type of vessel he has utilized continually, with the result of making his designs more and more perfect. The boat of which we are now speaking has been built for the Italian Government, and is of the largest size, being 100 feet long. She is of what is known as the Batoum class, and is very similar to many sent by Messrs. Yarrow to the Mediterranean, which have reached their destination in safety. She is propelled by a pair of compound engines capable of indicating about 500 horse power, steam being supplied by a boiler of the locomotive type. She has a two-bladed screw, the results of the experiments carried out by Messrs. Yarrow, and reported in our columns, showing that the two-bladed screw is better for high speeds than either the three or four-bladed propeller. This boat has attained the highest velocity ever reached by any vessel fully equipped and ready for action. Her measured mile speed is the highest ever officially recorded, namely, 22·46 knots, or very nearly 26 miles per hour. We believe, however, that in a private trial even this performance was slightly beaten. She is fitted with a bow rudder, by the aid of which she can be turned round almost in her own length; and the screw has been so designed as to give great backing power. This is regarded by all naval powers as a most important qualification, because in consequence of the extended use of machine guns, it is of the utmost importance to present as small a mark as possible to the enemy, and this can only be done by keeping bows on to the ship attacked. Immediately after the torpedo is discharged the boat goes ashore as quickly as possible, out of gun shot. The new boat is fitted with two tubes in the bows for discharging Whitehead torpedoes, so that she is a much more dangerous foe than the ordinary spar torpedo boats. She is steered from a point near the bows, the steersman being in a bullet-proof conning room; while the sloping deck forward is made of steel plates which would probably resist any but very heavy Nordenfelt or Gatling projectiles, so that the men engaged in getting the fish torpedoes ready for launching would be tolerably safe. The enormous velocity of the boat gives her a great advantage. It may be taken for granted that at a distance of one mile from a ship to be attacked she would be safe, and she need not approach nearer than 300 yards to discharge her projectile. Thus she would certainly have to remain under fire only while she was attacking. If she did not succeed, she would of course still be exposed to risk, but the chances are that she would succeed, when of course little more attention would be paid to her. But steaming at 22 knots an hour, she would be only in imminent danger for about 2½ minutes, during which time her range would be continually altering, and it would not be by any means easy to hit her.

We have said that she is the fastest craft afloat, and it might be supposed that this result is due in some measure to her comparatively large dimensions. It is ordinarily assumed that, other things being equal, the larger a ship is the more easily will she be propelled; that is to say, that the resistance of a steamship does not increase so rapidly as her dimensions. This law holds good with torpedo boats up to about 15 knots; and Mr. Yarrow has found that at that speed a boat 100 feet long and displacing about 25 tons can be propelled with absolutely—not comparatively—less power than a boat displacing 15 tons. But after 15 knots have been reached a new law appears to come into operation, and the resistance of the 25 ton boat is just the same proportionately, or nearly the same, as that of a boat of 15 tons. This is another of the anomalous results obtained at exceptionally high velocities.

The most noteworthy novelty in the new boat is an arrangement extremely simple, but none the less ingenious, for preventing the fire being put out should the stokehole be drowned. In all torpedo boats previously built, if shot entered the stokehole, and made anything like a large aperture, the furnace would be quickly submerged, and the boat would be left a helpless log on the water. For those who are not well acquainted with the internal arrangements of torpedo boats, it is proper to explain that they are divided into watertight compartments, in which are inclosed the engines, the boiler, and the stokehole, in which the coal is carried in sacks. The stokehole is shut down by air-tight lids, and a fan forces air into it to maintain the draught, which is very intense. The end of the boiler is, so to speak, fixed in a bulkhead, and in this are made two flap doors. The pressure of air in the stokehole forces open these doors, and the air then enters the compartment in which the boiler is fixed and gets into the fire through the ash pit and bars. It will be understood that there is no communication whatever with the ash pan from the stokehole. If a boiler tube burst while the fire door was shut, the smoke-box doors might be blown open; but the rush of steam and water would be confined to the compartment in which the boiler is, and the firemen could not be hurt, because the flap doors before alluded to would close and shut off the stokehole from the boiler room. The last improvement introduced by Mr. Yarrow consists in carrying up the sides of the ash pan above the bottom of the boat for about 3 feet 9 inches. The utmost depth to which the water can rise in the stokehole is 3 feet 3 inches, representing about 11 tons, which sinks the boat some 7 inches. The water rises some way up on the fire door; but this door is made of the cupped form, and the edges are a good fit against the plate. The result is that but little water gets past it into the fire box, and what does is immediately evaporated, and gives no trouble. Thus, in case of accident, the stokers would have time to withdraw from the stokehole, leaving the fire door shut. The fire box readily holds half a ton of coal, and this will keep up steam for forty miles at a speed of ten knots.

As torpedo boats are not intended to go far from a harbor it is clear that an ample margin of power is thus provided to give the boat an excellent chance of escape. In the absence of this appliance, should water in quantity find its way into the stokehole, the fire would be extinguished, and the boat left to float like a helpless log, a ready prey to the most insignificant adversary. On Wednesday, as the boat lay beside Westminster Steamboat Pier, the stokehole was drowned several times without in any way affecting the fire. Indeed, the steam pressure kept rising, although much steam was needed for pumping the stokehole out, and the draught was of course not on, the hatch to the stokehole being open. This we regard as one of the most important improvements recently effected in torpedo boats.

We may add in conclusion that, as the little vessel is intended for service at sea, she has a neatly fitted cabin, with sofas, which will accommodate four officers, while forward as many as eight men can be berthed with tolerable comfort. It would be quite possible for such a vessel to remain at sea for a week; and it is worth notice that she can carry coal enough to steam about 1,000 miles at a moderate speed. She will probably go to the Mediterranean under steam.

ENGINEERING INVENTIONS.

An improved storage tank for petroleum has been patented by Mr. Francis H. Benton, of Renovo, Pa. A stationary tank, a washing reservoir, supported on top of the tank, a short pipe connecting the top of the tank with the bottom of the reservoir, and a conducting pipe extending from the top of the reservoir downward on the outside of the tank and underground.

An improved nut lock has been patented by Messrs. James C. Beamer and John M. Richardson, of Carthage. Mo. The invention consists of two plates of strong sheet iron or other suitable material, wide enough to cover the fish-bar, with each edge resting on the rail. Each plate is centrally slotted, and the edges of the slot are turned outward wide enough and long enough to stand out over both nuts in the end of a rail. These plates are connected at one end with a spiral spring, and their other ends are formed into hooks that go around and under the ends of the fish-bar.

Improved Steel Tire Car Wheels.

Mr. L. W. Washburn, of Allston, Mass., is the inventor of a mould and process for casting steel tire car wheels that is of late attracting considerable attention. The object of this invention is to cast wheels of two distinct metals in such manner that the difficulty experienced by wheelmakers from unequal contraction is entirely obviated. The operation consists in first casting the center or body of the wheel from anthracite iron. While this part of the wheel is assuming a semi-molten state and slowly shrinking, a metallic ring, forming the outside periphery or tread of the body portion, is removed and another metallic ring of larger inside diameter, having a small fire cope attached, substituted therefor, after which crucible steel, sufficiently high in carbon as to render its running perfectly solid, is cast through the small fire cope, striking the upper outside edge of the still white hot center or body, and partially remelting it, thereby enabling the cast steel tire to thoroughly unite with the soft iron center, completing a wheel that must of necessity shrink from the center or hub, thus preventing any liability of cracking from unequal contraction. Were it not for the difference in grain and color, the *National Car Builder* says, it would be an utter impossibility to detect the line of union between the two metals. These wheels have already made a record of 100,000 miles before the first turning, between Boston and Chicago, under Wagner sleeping cars, and are guaranteed to run 200,000 miles. Owing to its composition, this wheel can be made at a great deal less expense than the steel wheels, while it answers the same requirements. They are now made in Canada, but arrangements are being completed for their manufacture in the United States.

A Twenty-one-Inch Hawser.

A rope of extra large size has recently been made for a firm in New Zealand, where it is to be used in hauling up ships when they run aground on the soft mud bottom there, which they occasionally do. This rope is a 21-inch white manila hawser, 120 fathoms long, and composed of nine strands of 316 yarns to the strand. Another rope for the same purpose is a 15-inch hawser of the same material and length, and composed of nine strands with 164 yarns to the strand. When it is remembered that 12-inch ropes are the largest ordinarily made, the magnitude of those just described becomes apparent. The two ropes were manufactured by Messrs. Frost Brothers, of Shadwell, England.

How to Soften Hard Water.

At the recent Health Congress at Brighton, the Mayor (Alderman Hallett) read a paper on the above subject, in the course of which he said the benefits to arise from softening chalk water for drinking purposes was often discussed, but unless a water company undertook the task, consumers continued to drink the hard water as though no remedy was within their power. His object was to state a means by which softened water could be obtained with little trouble and at small expense.

It was more than a quarter of a century since Dr. Clark, of Aberdeen, made known his valuable invention, and, as the patent had expired, the application of the system was open to all who were disposed to make use of it. His description was substantially as follows:

The invention was a chemical one for expelling chalk by chalk. Chalk consisted—for every pound (16 oz.)—of lime, 9 oz.; of carbonic acid, 7 oz. Nine oz. of lime, which could be obtained by burning in a kiln, required at least 40 gallons of water to dissolve it. This was called lime water. Chalk was very sparingly soluble in water, so that one pound would require 5,000 gallons to dissolve it; but if there was combined with it an additional 7 ozs. of carbonic acid, the chalk became readily soluble in water, and when so dissolved it was called bicarbonate of lime. If the quantity of water containing the one pound of chalk, with 9 oz. additional of carbonic acid, were 400 gallons, then the solution would be a water of the same hardness as well water from the chalk strata, and not sensibly different in other respects.

Thus it appeared that one pound of chalk, scarcely soluble in it by either of two distinct chemical changes—soluble by being deprived entirely of its carbonic acid, when it was capable of changing water into lime water, and soluble by combining with a second dose of carbonic acid, making up bicarbonate of lime.

Now, if a solution of the 9 oz. of burned lime, forming lime water, and another solution of the one pound of chalk and 7 oz. of carbonic acid, forming bicarbonate of lime, were mixed together, they would so act upon each other as to restore the two pounds of chalk, which would, after the mixture subsided, leave a bright water above. The water would be free from bicarbonate of lime; free from burned lime, and free from chalk, except a very little. A small residuum of the chalk remained, not separated by the process.

Of the 17½ grains in a gallon of water only 16 grains would be deposited and 1½ grains would remain. To soften water on a small scale, it was necessary to provide lime water about one-tenth of the quantity of water to be treated. He had used during the last twelve months two gallon stoneware casks with wooden taps. The casks were placed near a constant service tap; 1½ pints of lime water being first put in, the cask should be filled up to two gallons. After standing twenty-four hours, the supernatant water would be as clear as before, and at the bottom of the vessel would be found a precipitate of chalk.

The shape of the vessel would be better if cylindrical, with a tap hole a short distance up the side. This form of vessel would allow the process to be completed in twelve hours. The second cask or vessel was to form a reserve of the clear water which was being treated. He had been thus supplied without any difficulty.

There was no weighing of the lime required. If it was objected that the quantity was small, he answered, more casks could be used, or larger ones, so as to meet the requirements. This softening might easily be applied by laundresses by using larger casks, and the saving of soap would repay them for the little trouble.

Three years ago, when the Warren Industrial Farm School well was under discussion, it was said that soft water was a saving of many pounds per annum, compared with what would be the cost of using the town water. The town water was used now, and the time seemed to be come for the guardians to consider the use of a softening apparatus fitted for extensive use—Porter Clark's or the Atkins process.

The Sixth Report of the Rivers Commission (1874), page 205, put the saving in soap by the use of lime as follows: One cwt. of lime will do the work of 20¼ cwt. of soap; cost of one cwt. quicklime, 8d.; cost of 20¼ cwt. of soap, £47 1s. 8d. There was, therefore, very little question that the adoption of some mechanical means of mixing and rapidly filtering off the separated chalk would soon be paid for by the saving of soap.—*Journal of Gas Lighting.*

Antiseptic Properties of Esssence of Wintergreen.

We see in the *Concours Médical*, that Professor Gosselin and Dr. Bergeron have experimented with oil or essence of gaultheria (*Gaultheria procumbens*), wintergreen, and have obtained good results from it, as an antiseptic in the dressing of sores. Essence of wintergreen is much used in perfumery; it has an agreeable odor, and is insoluble in water, but soluble in alcohol.

Two solutions are used by Professor Gosselin:

No. 1. Oil gaultheria, f. ʒ i¼; alcohol, 60°, f. ʒ xiiss.; and No. 2. Oil gaultheria, f. ʒ ⅝: alcohol, f. ʒ iij.–f. ʒ j; water, f. ʒ xiiss.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

AN INQUIRY ANSWERED.

H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

MY DEAR SIRS. I have replied to inclosed letter from Mr. Good as follows, and perhaps you would be interested to know it:

"I have had Johns' Asbestos Paint upon the outside work of my house in exposed positions for four years, and after that time there is no chalky appearance, it does not rub off, has not worn or lost its color or brightness, and is in no need as yet of renewing. The paint is yet in good order. Some lead and oil paint on other parts of the house no more exposed than the Asbestos Paint, has been renewed twice, and the last coat is now worse looking than the four-year-old Asbestos Paint. The roof of my piazza, painted in stripes of red and green of Johns' paints three years ago, is still bright and fresh and in good order." HENRY STEWART,

Formerly Editor *American Agriculturist.*

Elm Boards Wanted.—C. Ledig, 13 Peck Slip, N. Y.

Attention, Patentees.—A Good, Practical Invention Wanted for Introduction. Address C. M. H., Room 31, 157 Broadway, New York.

For Belt Studs, Belt Hooks, Belt Couplers, Belt Punches, Baxter Wrenches, write Greene, Tweed & Co., N. Y.

Type Writer Wanted; good and cheap. Penfield Block Co., Lockport, N. Y.

Wanted.—Manufacturers of Lubricants addresses. Box 777, Bradford, Pa. Wm. J. McDougall.

List of 3,000 responsible Farmers in Penn., New Jersey Md., and Va., *selected.* Mailed on receipt of $2. *Farmers Register*, 2623 Warnock St., Philadelphia, Pa.

"Little Giant" Engines and Boilers, users say, are "the best ever made." Madison Machine Co., 406, 408 Broadway, New York.

Valuable Patent for Sale; price low. Address A. B., Post Office Box 2032, Philadelphia, Pa.

Our goods rank first for quality, safety, and durability. Please compare them with any other make, and if not found better and cheaper, quality considered, we will bear the expenses of the trial. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Granville Hydraulic Elevator Co., 1193 B'way, N. Y.

The *Mining Record*, devoted to mining, contains the latest reliable reports from all the mines, with perfect reports of the Mining Stock Market. Subscription, $4 yearly. Sample copies free. A. R. Chisolm, Proprietor, 61 Broadway, New York.

For Leather, Rubber, or Cotton Belting, Linen Hose or Rubber Hose, write Greene, Tweed & Co., New York.

To Stop Leaks in Boiler Tubes, use Quinn's Pat. Ferrules. Address S. M. Co., So. Newmarket, N. H.

Light and Fine Machinery and Tools to Order. Lathe catalogue for stamp. Edward O. Chase, Newark, N. J.

Malleable and Gray Iron Castings to order, by Capital City Malleable Iron Co., Albany, N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N. J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Improved Skinner Portable Engines. Erie, Pa.

Clark & Heald Machine Co. See adv., p. 62.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 61.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 60.

Skinner's Chuck. Universal, and Eccentric. See p. 61.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 77.

The Sweetland Chuck. See illus. adv., p. 78.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N. J.

Peck's Patent Drop Press. See adv., page 94.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 92.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Engineer, J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks. Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Paragon School Desk Extension Slides. See adv. p. 93.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Brass & Copper in sheets, wire & blanks. See ad. p. 94.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 93.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 93.

Supplee Steam Engine. See adv. p. 93.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 95.

Sewing Machines and Gun Machinery in Variety. The Pratt & Whitney Co., Hartford, Conn.

Saw Mill Machinery. Stearns Mfg. Co. See p. 93.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Lightning Screw Plates and Labor-saving Tools, p. 93.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

TO OUR CORRESPONDENTS.—The destruction of ourold offices by fire January 31, 1882, caused the loss of a considerable number of inquiries from correspondents and of our replies thereto, which we had in hand for publication. Those of our friends who find their inquiries neglected will know from the above the reason why; and they will oblige the editor by repeating their inquiries without delay.

(1) J. W. L. asks: Will the result be the same in hardening steel either by a charcoal fire or by illuminating coal gas? Process; 100 twist drills packed close in a 1½ inch wrought iron tube, one end left open to the fire; to be heated exactly the same temperature in both cases, and to be cooled in sperm oil. A. Yes; if heated to the same temperature they can only be uniformly heated with gas by using great care. A better mode of heating is in a metal bath of proper composition, and kept at uniform temperature above the fusing point.

(2) F. P. H. asks: What is the best form of engine for aeronautical experiments? A. Direct acting; working parts light; made of steel or gun metal. It should be accurately balanced, and run at high velocity.

(3) B. C. writes: On burning white (letter) paper on an earthenware dish a dark thick substance is left. Will you please let us know of what it is composed? A. Carbonaceous matters and ash or mineral matters. The latter vary with different papers. Usually this part of the residue consists chiefly of talc or soapstone (silicate of magnesia), clay (silicate of alumina) and sulphate of alumina. By heating the mass to redness for a few minutes in contact with air the black carbonaceous matter burns away, the mineral portion alone remaining. Talc, clay, and alum compositions are used in weighting and sizing the paper, hence their presence in the ash.

(4) G. W. S. asks: Can you give a receipt for plating metals—anything that will change the color of brass to imitate silver? A. You will find direction for plating brass, etc., in SUPPLEMENT, No. 310.

(5) E. M. E. asks why smokestacks of ships are somewhat inclined backward, while it is not o on steamboats, locomotives, etc. I have found no one yet to give me a satisfactory explanation. A. It is a mere fancy of the builders to make the ship look more "rakish."

(6) C. C. asks: Why are oscillating engines not more generally used? A. Because of unequal wear and somewhat complicated valve gear.

(7) J. B. B. asks whether we consider the so-called granite and marblized ware now so commonly sold as a safe article to use for culinary purposes. A. According to recent tests by our health authorities these enamels do not appear to be unwholesome, and are not liable to contaminate food cooked in contact with them.

(8) F. M. L. asks: Has any means been devised of using as fuel the siftings, dust, etc., of coal mines? If so, what is the device? A. Yes; they are burned successfully on some of the locomotives of the Pennsylvania Railroad, by a patent apparatus or arrangement. We cannot give you the details.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. H. J.—It is not meteoric—but consists chiefly of augite and quartz—possibly carrying a little zinc and silver.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 24, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Agitator or egg beater, G. W. Richardson 252,800
Amalgamator and concentrator, A. Oliver 252,793
Animal trap, F. Winslow 252,852
Arch bars, machine for bending and punching, C. G. Cross 252,741
Augers, countersink attachment for, C. W. Cutter 252,650
Axle box, carriage, F. A. Carnes 252,733
Bag fastener, T. Sanford 252,804
Bag holder, F. Allen 252,640
Ball trap for billiard tables, F. Saunders 252,805
Battery. See Voltaic battery.
Bed bottom, C. H. Fitch 252,654
Bed bottom, spring, O. S. & W. S. Foster 252,601
Bed bottom, spring, M. A. Hunt 252,772
Bed bottom spring, T. A. & W. H. Rhodes 252,701
Bed lounge, J. L. Newton 252,791
Bicycle, J. E. Richard 252,624
Bird cage feed cup, J. Maxheimer 252,611
Bitters, alterative and tonic, D. W. Edwards 252,652
Blind, inside window, E. W. Bowslaugh 252,833
Boiler. See Steam boiler.
Boiler furnace, J. Gerber 252,656
Bolts, manufacture of, C. Hall 252,661
Book, manifold copying, J. R. Carter 252,646
Box. See Axle box. Letter box. Post office lock box. Toy money box.
Bracelet stock, die for striking up, Keller & Frey. 252,676
Bracket. See Lantern bracket.
Brake. See Car brake.
Brick and mould, angle, J. F. Edwards 252,747
Brick and tile machine, A. Wehlann 252,636
Burner. See Gas burner. Hydrocarbon burner. Vapor burner.
Butter cutter, J. Porsch, Jr. 252,698
Button hole cutting machine, C. E. Langmaid 252,781
Button setting instrument, G. W. Prentice 252,699
Calender for cloth and other fabrics, Sarfert & Vollert 252,625
Canister or store can, D. F. Goodyear 252,759
Car, T. L. Wilson 252,830
Car brake, C. Higham 252,662
Car coupling, E. P. Goodrich 252,602
Car coupling, C. L. Horack 252,767
Car coupling, F. Johnson 252,775
Car coupling, W. Scott 252,809
Car for railways, wrecking and construction, L. K. Jewett 252,672
Car, railway, W. P. Prewitt 252,855
Car, stock, I. Kitsee 252,777
Car wheel, J. V. Dinsmore 252,745
Cars, heating and ventilating, M. D. Fitzgerald 252,752
Cars, ventilating, M. C. Jones 252,673
Carding machine, J. Wall 252,821
Carpet fastener and stair rod securer, combined stair, C. D. Stone 252,850
Carpet fastener, stair, M. Krickl 252,680
Carrier. See Thrashing machine straw carrier.
Case. See Piano case.
Chandelier, drop light, J. Trigge 252,709
Chain, drive, C. H. Low 252,609
Chinoline, preparation of, Pickhardt & Endemann 252,846, 252,847
Cigar holder, W. J. Fitzgerald 252,753
Cigarette machine, E. Side 252,811
Clamp, A. Kraiss 252,779
Clasp. See Corset clasp.
Clay, lawning and cleaning, S. G. Phillips 252,796
Clock movement, A. E. Hotchkiss 252,668
Coffee, compound for flavoring, F. Broz 252,723
Coke crusher J. R. Davis 252,743
Comb, V. W. Wilson 252,856
Corn sheller H. A. Adams 252,594
Corset clasp, W. F. Gilbert 252,756
Counter stiffeners, treating hide in the manufacture of, W. H. Metcalf 252,688
Coupling. See Car coupling. Cultivator beam coupling. Pipe coupling. Shaft coupling.
Crib and table, interconvertible, S. S. Burr 252,730
Crusher. See Coke crusher. Quartz crusher.
Crushing sugar, salt, etc., device for, E. P. Chesbro 252,738
Cuffholder, false, G. A. McIntire 252,789
Cultivator, A. Gump 252,837
Cultivator beam coupling, J. T. Hamilton 252,763
Cultivator, wheel, T. A. Palm 252,794
Cultivator, wheel, P. F. Wells 252,637
Cup. See Bird cage feed cup.
Curtain cord tightener, C. Schwaibold 252,807
Curtain fixture, Darling & Griswold 252,742
Curtain fixture, H. S. Wing 252,851
Cutter. See Butter cutter. Pipe cutter. Vegetable cutter.
Dental articulator, L. & J. W. Manker 252,785
Die. See Pipe die.
Digger. See Potato digger.
Draught equalizer, J. Horrigan 252,667
Draught equalizer, J. Sebastian 252,810
Draught equalizer, C. L. Spencer 252,813
Drier. See Fruit drier.
Drill and countersink combined, W. H. Southwick 252,704
Earring, H. G. Mackinney 252,610
Electric cable, R. S. Waring 252,634
Electric lighting apparatus, M. G. Farmer 252,748
Electric lighting system, M. G. Farmer 252,836
Electric machine, short circuiting switch for dynamo, W. Hochhausen 252,663
Electric machines, polarity protector for dynamo, W. Hochhausen 252,665
Electric signaling apparatus, Pickford & Gregory. 252,797
Elevator, H. Roberts 252,801
Elevator safety attachment, F. T. Ward 252,710
Embroidering machine, C. A. v. Gonzenbach 252,659
Engine. See Road engine. Rotary steam engine. Steam and air engine.
Evaporating salt brine, McBean & Watson 252,612
Explosive compound, C. Dittmar 252,600
Fan, C. Strickrodt 252,706
Farm engine boilers, fire box attachment for, H. Gillett (r) 10,016
Faucet, measuring, J. H. Blum 252,644
Fence, electric wire, J. H. Connelly 252,599
Fence, portable, S. K. Rahn 252,621
Fence, wire, E. Ruane 252,702
Filter, water, A. Bell 252,718
Fire alarm, automatic, I. Kitsee 252,677
Fire annihilator, I. Kitsee 252,678
Firearm, breech-loading, H. Scott 252,703
Fire escape, G. W. Levi 252,839
Fire escape, Williams & Rundle 252,829
Fire kindler, E. E. Glaskin 252,757
Foot protector, W. Klein 252,778
Frame. See Lounge frame. Mosquito bar frame.
Fruit drier, domestic, J. B. Sweetland 252,815
Fruit jar cover, G. H. Brown 252,721
Furnace. See Boiler furnace.
Gauge. See Water gauge.
Galvanic pad, L. Hechinger 252,765
Gas burner, electrical, J. Redding 252,848
Gas for preserving food, preparing, E. R. McCall. 252,787
Gas lighting, electric, J. Redding 252,849
Gate, W. O. Stickler 252,629
Gelatine and glue from animal refuse or offal, manufacture of, A. J. Huet 252,771
Glove fastening, S. Montgomery 252,617
Grain header, J. W. & A. B. Jory 252,776
Grain separator and cleaner, D. Salisbury 252,803
Grate, J. Kraupa 252,606
Grinding and reducing grain, etc., mill for, J. Stevens 252,705
Guard. See Spinning machine thread guard.
Hame staple, C. Lange 252,780
Handle. See Plow handle.
Harrow and seed sower combined, sulky, A. C. Scarr 252,806
Harrow evener, H. H. Fischer 252,751
Harvester, W. N. Whiteley 252,826
Harvesting machine, L. H. Lee 252,681
Harvesting machine, C. M. Young 252,854
Heel trimming machine, Tyler & Stone 252,819
Hinge, spring, H. Howson 252,770
Hoisting and conveying apparatus, F. A. Clarkson 252,740
Holder. See Bag holder. Cigar holder. Cuff holder. Pin jewel holder. Stereotype plate holder.
Homologues of phenol, naphthol, and resorcin, manufacture of the higher, A. Liebmann 252,782
Hoof protector, J. M. Goodman 252,758
Hook. See Snap hook.
Hoop cutting machine, L. Holt 252,666
Hopper, feed, J. R. Walsh 252,633
Horseshoe, J. B. Finch 252,750
Hydrocarbon burner, liquid, A. S. Munger 252,618
Insulator for telegraph wires, C. L. Gore 252,857
Ironing table and clothes bars combined, H. Keeler 252,675
Jug, J. Cook 252,649
Knob attachment, B. H. Lockwood 252,682
Lamp and generator, combined electric, E. Morey 252,691
Lamp, electric, H. S. Maxim 252,840
Lamp, gas, C. W. Muchall 252,692
Lantern, A. L. Baron *et al* 252,642
Lantern bracket, W. M. Phelps 252,697
Lathe, engine, G. A. Gray, Jr. 252,760
Lathing, metallic, A. Knisely 252,679
Lead by the old Dutch process, corroding house for the manufacture of white, W. H. Wetherill 252,823
Leading staff for bulls, S. M. Wells 252,638
Leaf and plant, artificial, C. I. Hahn 252,762
Letter box, street, T. McLaughlin 252,842
Lever, steam, J. B. Collin 252,598
Life preserving garment, C. Williams 252,828
Lock. See Nut lock.
Lounge frame, J. F. Komp 252,604
Lubricant, W. Parkinson 252,606
Magneto-electric machine, W. Hochhausen 252,664
Metal articles, machine for bending and shaping, A. R. Woodyatt 252,853
Metallic fastener, G. W. McGill 252,685
Mill. See Roller mill. Sugar mill. Windmill.
Mosquito bar frame and canopy, combined, C. P. Howe 252,769
Motion, device for converting, J. W. Anderson 252,831
Motion, mechanism for converting rotary into oscillating, J. Hornig 252,768
Motor. See Windmill motor.
Mucilage receptacle, W. Kennish 252,603
Musical instrument, automatic, J. McTammany, Jr. 252,614
Musical instrument, mechanical, Morris & Brott 252,844
Nail driving machine, J. J. Burk 252,834
Nut lock, Beamer & Richardson 252,716
Nut lock, A. Berryhill 252,719
Nut lock, B. F. Click 252,647
Nut lock, J. Frederick 252,655
Ore concentrating and separating apparatus, M. J. Butzel 252,731
Ore washer, S. P. Speers 252,812
Organ stop action, reed, W. C. Kantner 252,674
Overstitching machine, J. E. Richard 252,799
Oxidizing lead bullion containing precious metals, apparatus for and process of, J. Tunbridge 252,817
Pad. See Galvanic pad.
Parer, apple, F. W. Hudson 252,670
Pea shelling machine, F. Molini 252,616
Piano case, J. & J. P. Becker 252,717
Pin jewel holder, F. Gundorph 252,660
Pipe coupling, J. C. Githens 252,657
Pipe cutter, C. Fenton 252,749
Pipe die, drain, W. L. Ogden 252,693
Pipe gripe, W. B. Tatro 252,632
Planter and fertilizer distributer, corn, W. Cassill 252,736
Planter corn, L. Scofield 252,808
Planter, cotton, Byers & Dorser 252,732
Planter, cotton and corn, J. M. Turley 252,818
Planter, seed, J. W. Robertson 252,802
Plow attachment, R. Updike 252,820
Plow handle, W. P. Brown 252,722
Plow handles, bending, G. C. Avery 252,712
Plow, sulky, H. Miller 252,615
Post office lock box, W. H. Taylor 252,708
Potassium, manufacture of carbonate of, C. R. Engel 252,653
Potato digger, J. J. Meierdircks 252,687
Press. See Printing press.
Pressure regulator, pneumatic, H. F. Fitzpatrick. 252,754
Printing press, J. Henry 252,838
Protector. See Foot protector. Hoof protector. Sole and heel protector.
Pump, G. S. Bartlett 252,643

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Pump vacuum, H. Goebel 252,658
Punching machine feeding device, F. Marggraff .. 252,786
Quartz crusher, A. Oliver 252,792
Railway switch, A. E. McDonald 252,684
Reaping machine, J. Harris 252,764
Refrigerating apparatus, J. T. Reed 252,632
Refrigerating apparatus, dynamic dry air, E. Hill 252,766
Refrigerator, J. McMurtry 252,613
Regulator. See Pressure regulator.
Reservoir, portable distributing, D. R. Miller 252,690
Ring. See Earring.
Road engine, H. H. Bridenthal 252,720
Roller mill, C. Gates 252,755
Rotary steam engine, Hyden & Larson 252,773
Saw mill, circular, C. J. L. Meyer 252,689
Saws, machine for brazing band, J. F. Komp 252,605
Scale platform support, W. E. Sellock 252,627
Scraper, foot, R. B. Hough 252,669
Screw cutting die stocks, pipe cutting attachment for, A. H. Jarecki 252,671
Screw wrench, J. H. & F. L. Coes 252,597
Seams of sheet metal cans, closing the, G. H. Perkins 252,795
Separator. See Grain separator.
Sewing machine work basket, J. L. Parkinson 252,695
Shaft coupling, J. H. Riddle 252,700
Sheller. See Corn sheller.
Shoe, G. H. Bass 252,715
Shovel. See Snow shovel.
Shutter worker, T. N. Lupton 252,784
Sign, E. Grah (r) 10,014
Signal for railway and other purposes, Wilbur & Sanford 252,827
Sinker and fish hook holder, combined, S. E. Smith 252,628
Smoke stack and spark arrester, W. F. Cosgrove (r) 10,013
Snap hook, A. Bernd 252,832
Snow plow, N. Witts 252,639
Snow shovel, C. A. Way 252,822
Soap slotting machine, J. Atkiss 252,711
Soldering cans, flat seam knife for use in, R. Neil. 252,845
Sole and heel protector, comb'd in, W. T. Schenck 252,626
Spinning machine thread guard, E. S. Stimpson ... 252,814
Spring. See Bed bottom spring. Vehicle spring. Wagon bolster spring. Watch click spring.
Spring, R. A. McLean 252,686
Staples, machine for inserting and clinching, G. W. McGill 252,841
Steam and air engine, combined, E. M. Strange ... 252,630
Steam boiler, T. McDonough 252,788
Steam boiler, W. R. Michener 252,843
Steel for watch springs, preparing, Watson & Willson 252,635
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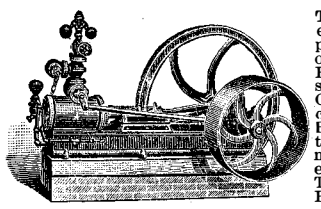

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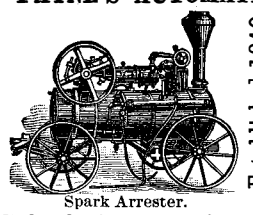
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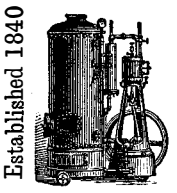

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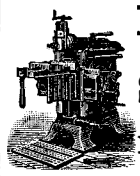

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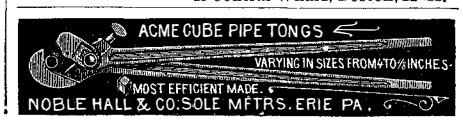

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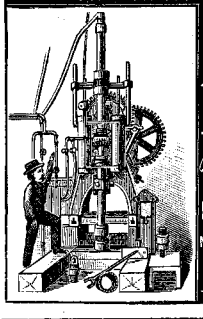

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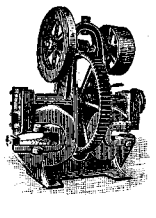

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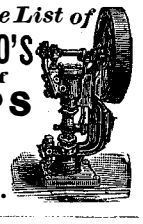

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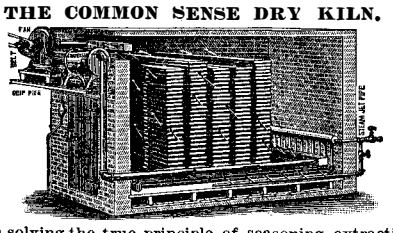

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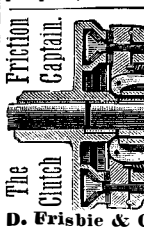

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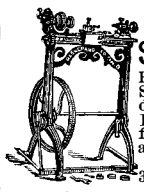

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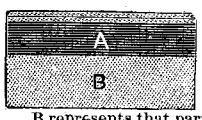

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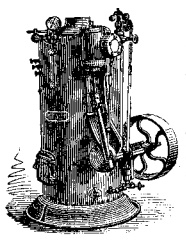

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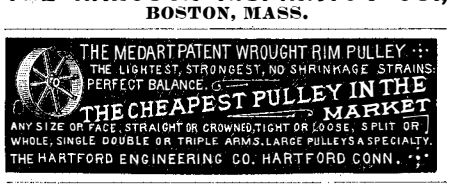
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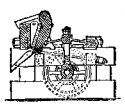

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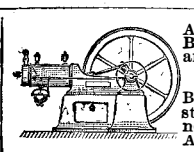

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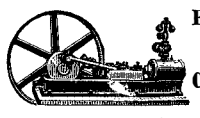

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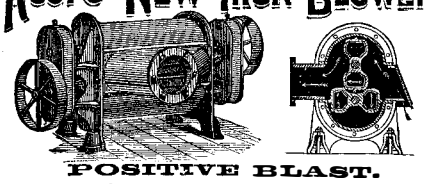

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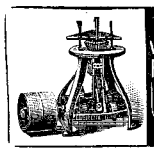

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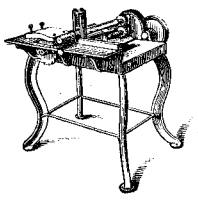

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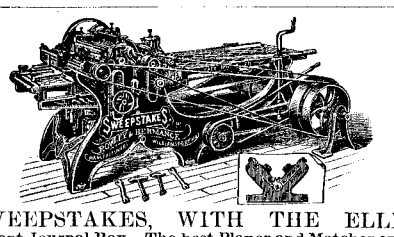

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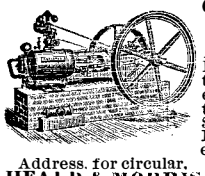

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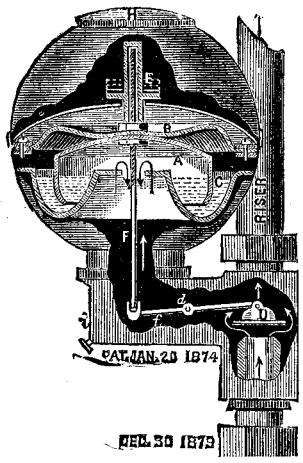

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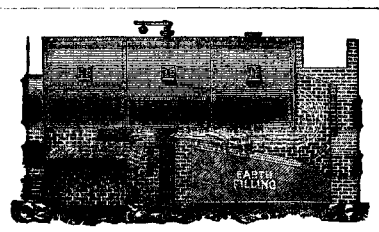

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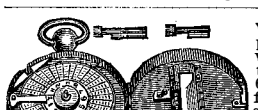
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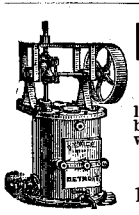
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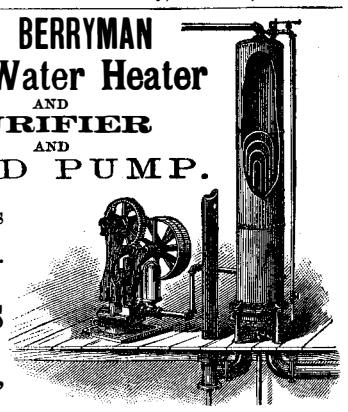

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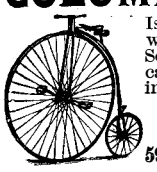
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